Editorial

NEW ZEALAND is facing up to the problem of TV standards in much the same way as we did a few years ago. At the moment there is strong support for the adoption of the English standard of 405 lines 50 frames and AM sound.

The main reason advanced for using this standard is that TV should be approached as a problem of economics rather than one of techniques.

It is undoubtedly cheaper and easier to have TV with 450 lines than with 625 lines. It is held, too, that in practice, remembering the inevitable picture degradation due to receiver misalignment and so on, the 405 line picture often gives a better result. than one using a larger number.

The narrow bandwidth of the 405 system will allow four channels to be used between 48 and 68 Mc, a band which can be covered easily with a single tuning system, and on which it is easier and cheaper to get a high standard of receiver performance than at 200Mc.

Some of these ideas are factual, and some are open to discussion. It is easy to be sympathetic with New Zealand's desire to have TV as cheaply as possible consistent with a good system. It is true also that the 405 system will be the cheapest.

But TV design is advancing very rapidly, and in a year or two the gap may not be so wide. Nor need we accept as inevitable a degradation of pictures in practice so that a higher lineage is not worth while.

All these things were undoubtedly thrashed out before 625 lines was adopted as a world standard by the ITC.

It is most important to remember that any system now adopted must be retained for many years before any change will be practicable, and even then some major advance involving fundamentally new techniques would no doubt be required to affect the picture lines.

As far as Britain is concerned I feel sure her main interest in supporting the 405 line system is the possibility of exporting TV equipment off the hook. I do not believe she would adopt anything less than 625 lines if starting afresh.

It may be that with TV systems in England on 405 lines, USA on 525 lines, France on 819 lines, and parts of Europe on 625 lines, standardization seems a bit hollow. It may be that world TV links are a long way off.

But the impossible and improbable have a habit of being common practice much sooner than we think. Some day it may be very important for New Zealand to link with Australia and with the rest of the world. This would be so much easier if they were in step.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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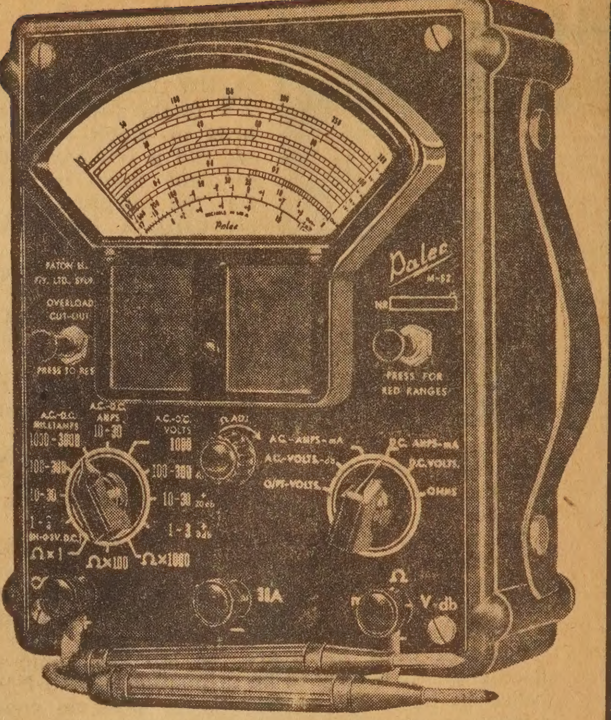

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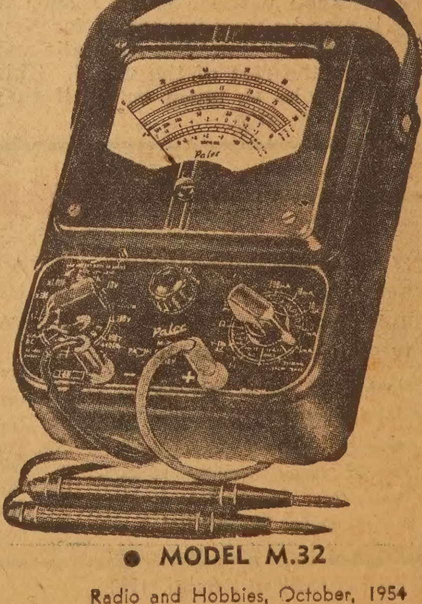

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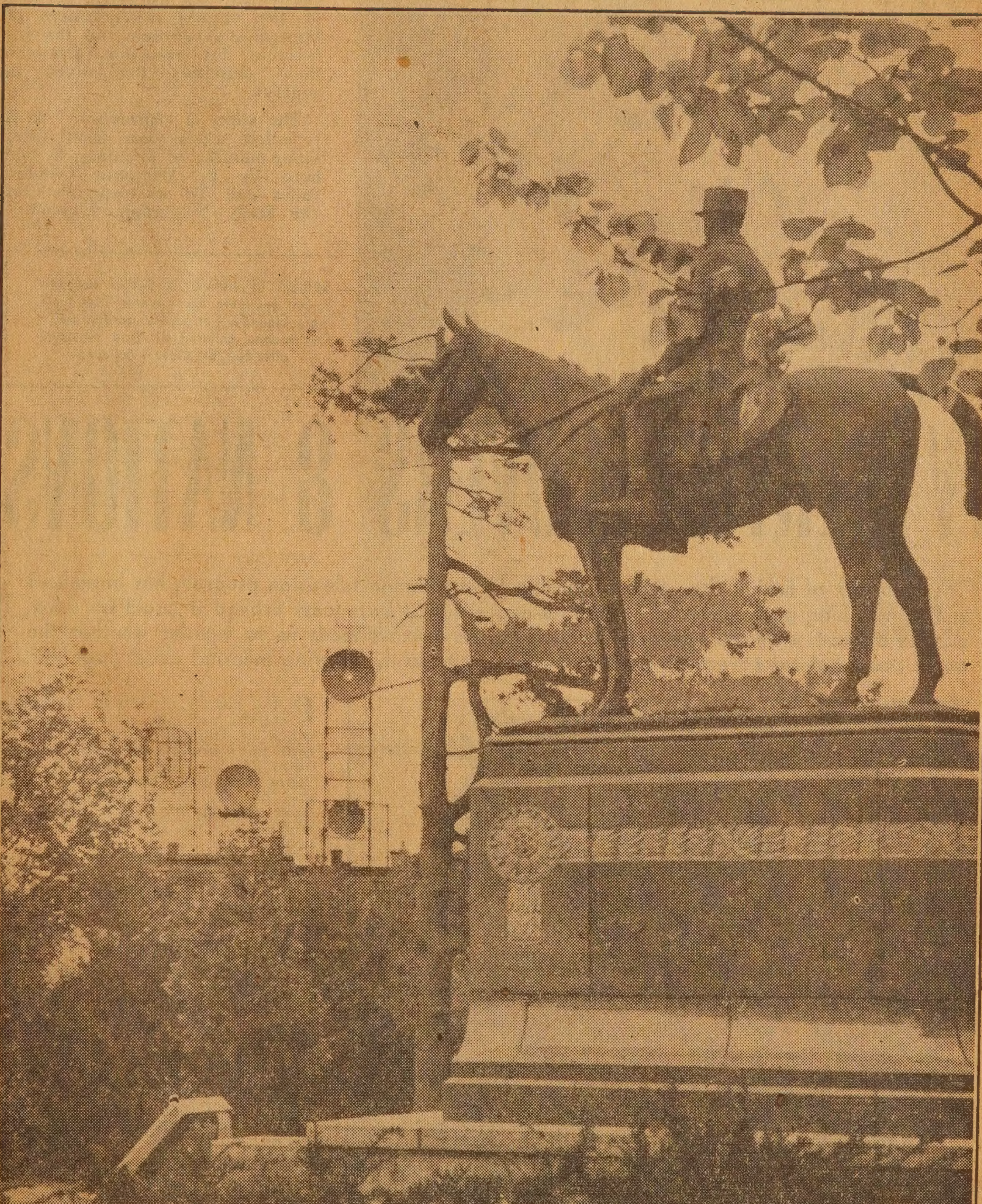
TV PROGRAMS COVERED EUROPE



AERIALS IN FRANCE.—In the distance, behind the statue of Marshal Foch in the Casino gardens at Cassel, are the aerials on the Casino roof that helped to make the Continental TV exchange possible. On the right are the main and diversity relay aerials surmounted by RT communication yogi array. Centre and left are the propagation test aerials (story overleaf).

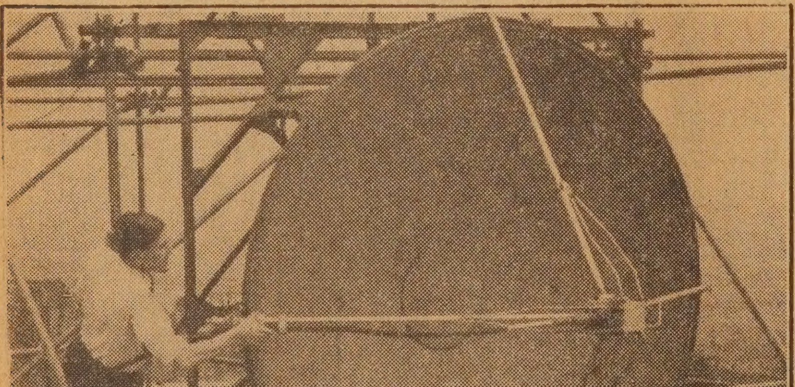
Millions of viewers in Britain saw this scene on their TV screens, broadcast from Holland. It was a garden party for refugee children at Gud Noarden attended by Queen Juliana.

Whether this broadcast will be repeated, at least for some time, is hard to say, but undoubtedly it will lead to a gradual extension of relay facilities without which it could not be achieved. The possibilities are attractive because of the intense concentration of European population and the inevitable inter-reaction between their activities and lives in general.

The story of "Eurovision" as it is called, which came about after many months of planning, is told here by L. Marsland Gander, radio and TV correspondent of the Daily Telegraph, London.

TV SERVICE COVERS 8 NATIONS

The prospect of linking the whole of Europe to a common television program has important and far-reaching possibilities. Recently an experimental broadcast proved it could be done, despite difficulties due to incompatible systems. Its success leads us to wonder whether the world could not be covered by a vast network, ultimately to bring mankind closer together.



On the Casino roof at Cassel, engineer A. P. Carter is seen making adjustments to the 8ft diameter diversity 2000 Mc aerial showing launching unit and feeder.

IN the history of human communications and the gradual coalescence of mankind, few events will rank more importantly than the creation of the first European television network. Distances involved and the size of the scattered audience, though these are impressive enough, are not the measure of the achievement.

The triumph is that eight countries speaking different languages and using differing technical standards, separated by race, geography and political frontiers joined to watch, by the magic of television, a common program. Britain, France, Germany, Switzerland, Italy, Holland, Belgium and Denmark have set up a network which extends, altogether, for nearly 4000 miles (6400 kilometres), links 44 stations and serves an area inhabited by 90-millions. Eighty relay transmitters are being used.

FIRST PROGRAM

The first programs, arranged for June 6, were the Swiss Fete des Narcisses, from Montreux, and a visit to the Vatican in Rome, ending with a benediction by the Pope from the throne room. The last program in the experimental month was the final of the world football championships from Switzerland on July 4. On 17 days during this period there were a total of 26 programs from the various participating countries, including many of the world championship football matches from Switzerland, a providential common denominator in television entertainment for all Europe.

"Eurovision" is the name coined for this great experiment, organised by the European Broadcasting Union. Britain is vitally interested for a number of reasons. She was first in the field with television—in 1935-6—and, therefore may be fairly said to have a know-how based on longer experience than that of any other country in Europe. Moreover, television has reached a far more advanced stage of development there than in any of the other seven countries. There are 3,300,000 receivers in use and national coverage has been achieved. France, the nearest competitor, still has only about 100,000 sets, and Germany, though making rapid progress, only 20,000.

BRITAIN-FRANCE

Britain, collaborating with France, pioneered Eurovision. The first example in the world of genuinely international television was provided in August, 1950, when the British Broadcasting Corporation sent an hour's program from Calais that was seen by English viewers. But it was not two-way traffic. Another big step was taken two years later when 18 programs, originated in Paris by the BBC, were seen simultaneously by the television audience in both countries. Then last year the Coronation was seen in Belgium, Holand, Western Germany and Berlin. Now Eurovision, at last, is a two-way traffic.

Britain is also vitally concerned with Eurovision for even more basic considerations. All eight countries involved are using United Kingdom-made equipment, to a greater or less degree, and the total value is calculated at about £2-million. It includes transmitters, cameras, studio apparatus, outside broadcasing units and vehicles, numerous micro-wave links to relay signals from point to point. The most spectacularly placed of these United Kingdom-made links is in Switzerland, 10,000ft (3048 metres) up amid the snows of the Jungfrau. It joins Switzerland to Italy, which, incidentally, is probably the country using more United Kingdom equipment than any other on the Continent.

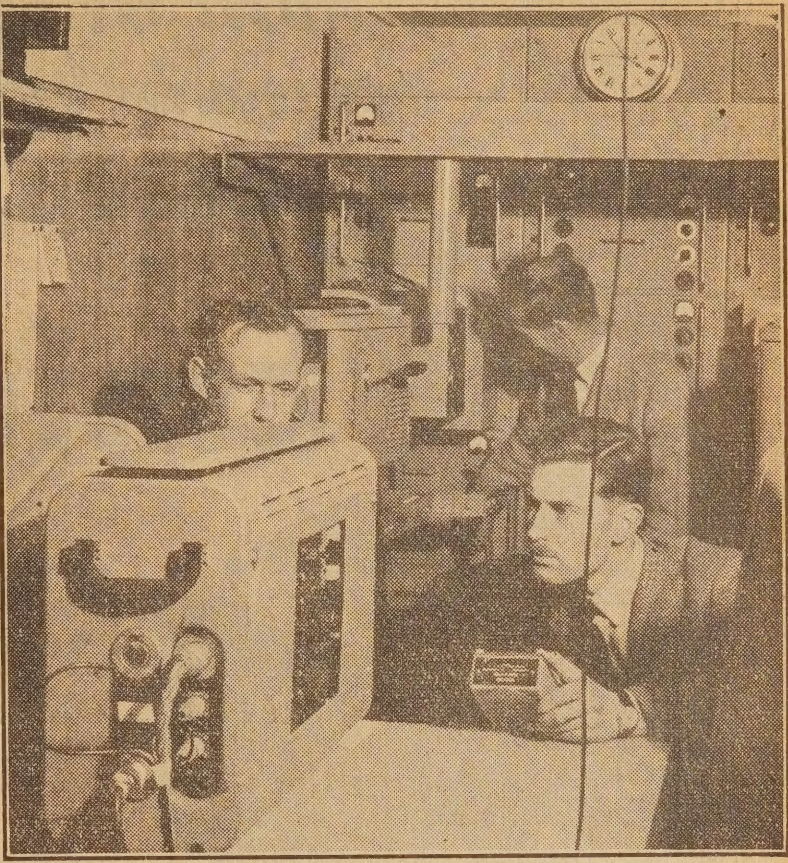
Two fundamental technical achievements have made Eurovision possible. One is means of converting the picture from one standard to another—and four different standards of definition are being used in Europe today. The second was the production of lightweight micro-wave links, which, working in tandem, could, in a series of short leaps, cover any distance.

Until 1950 the greatest distance that a television station could reach out to bring in an outside program was little more than 25 miles (40 kilometres). Conversion from one definition to another, which looked an insuperable problem in the years 1946-8, had, by 1950 been solved in the simplest way—by taking a picture of a picture. In other words, a camera on one definition took a picture off a screen using another and then passed it along the chain.

BBC FEATURES

The BBC's main program contributions to the network were arranged for June 12 when five separate transmissions were due to originate there, a greater number than from any other country in one day. First, early in the afternoon there was planned a 20-minute transmission from the athletic championships in Glasgow, showing overseas teams competing. Immediately afterward Queen Elizabeth II was to review a Royal Naval Volunteer Reserve Parade on the Horse Guards' Parade in London. Then was coming an hour's visit to the Richmond

CHANGE TO BRITISH STANDARD



Engineers at Swingate testing standards conversion equipment to ensure that no technical hitch should mar the eight nation exchange.

LA MAISON DE LA LAI

From the market square at Cassel this is how the aerials linking Cassel with Swingate, near Dover, looked.

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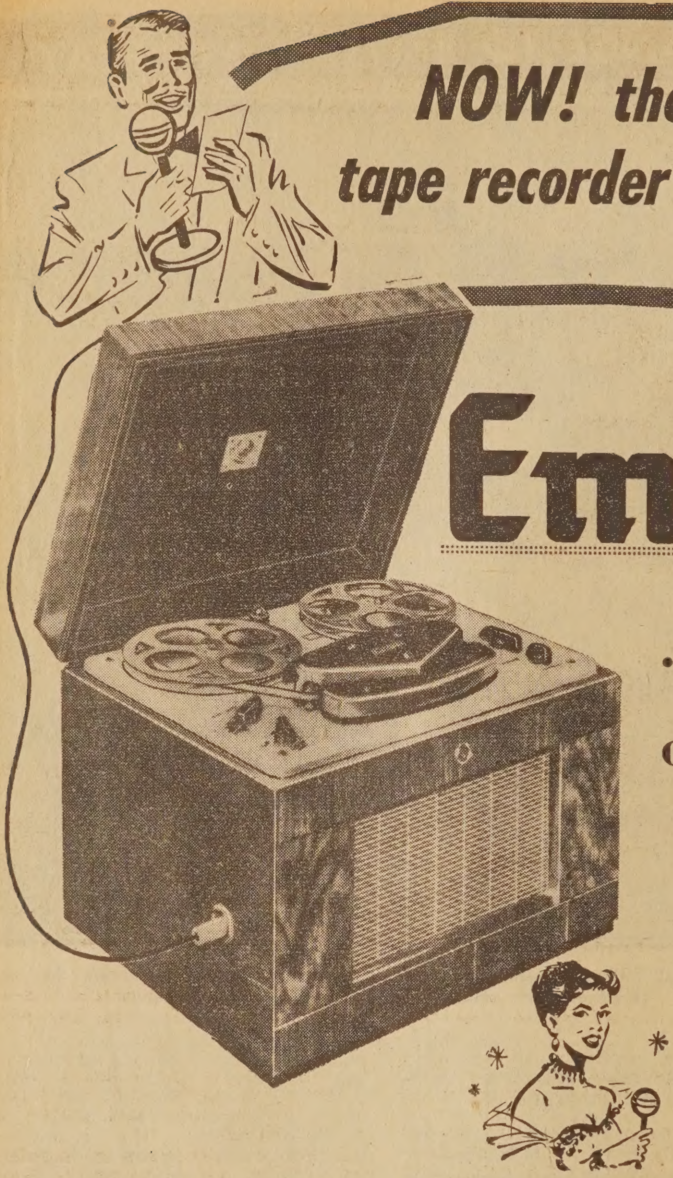

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TR.7.FP

Horse Show, another event with international appeal.

All Europe asked the BBC to provide light entertainment, a scarce commodity in television. Accordingly, it was planned to transmit in the evening, from London, Henry Caldwell's international cabaret Cafe Continental. For the fifth and final item, a tour of London at night was arranged, using the new and more compact mobile unit called "the Roving Eye". This one-camera transmitter, in a shooting brake, is much smaller and more convenient than any previous outside equipment used by the BBC. It showed Continental watchers some of London's most familiar sights.

TYPICAL ITEMS

Other items during the month ranged from floodlit scenes at the Palace of Versailles to the famous Palio medieval horse race at Siena, Italy; from a promenade along the Rhine to a midsummer night program from the Tivoli Gardens, Copenhagen.

The possibilities of breakdowns are many but it is a safe prophecy that one day the brave adventure of June, 1954, will lead to the creation of a permanent network.

The remainder of the Eurovision story is told in the pictures reproduced herewith, which highlight some of the difficulties associated with it.

Probably the most important item in such a link, whether in Europe or anywhere else, is the provision of the relay stations which leapfrog the programs from one centre to another.

The distance between these stations is limited virtually by the line of sight between the aerials. Micro-wave radio is used, and radiation beamed by the use of special aerials, generally reflector "dishes" of the type shown in the pictures.

These function much like the reflectors of a cone type radiator or a searchlight. By concentrating the available energy into a narrow beam, the best use is made of the available power, and interference from sources outside the beam is avoided.

A strong signal, free from distortion or interference, is essential if the picture at the end of the journey is to remain clear.

HIGH POSITION

That is one reason why the aerials in the pictures are all mounted high up in the air. The higher they are, the greater the length of the optical path between them. According to the siting of the aerials, the path lengths between the stations in the links could vary between 10 and 50 miles, and occasionally further than this.

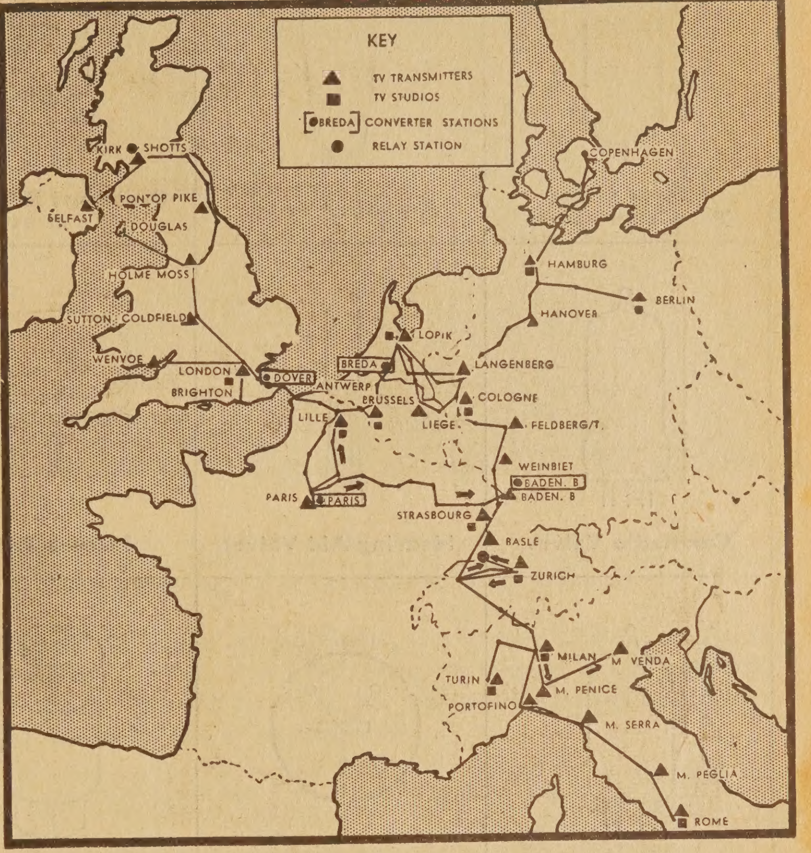
There will be a degree of deterioration in the picture as it travels through the various link stations, as the process of reception and retransmission is not made without some loss. In this regard it is something like the loss in definition which inevitably follows repeated copying of movie film.

The deterioration of the picture is likely to be one limitation of the distance it would be practicable to transmit a television image, particularly if the original was not handled by a high definition system.

In this respect, England may be at a disadvantage, for her 405-line system, despite the care that has been taken to make the most of it, is likely to be the lowest definition system in Europe. France, which has probably the highest, is 819 lines—almost double that of England. It is not reasonable to think that a 405-line picture retransmitted and converted to 819 lines would be as good as one transmitted wholly on 819 lines. But the retransmission of 819-line pictures on the 405-line system should be much more successful.

If the picture shown here of a TV screen taken during a Eurovision relay is a fair representation, the picture quality is not good. The line structure is extremely noticeable, and this is just what would be expected after retransmission and conversion.

MAP SHOWS EXTENT OF RELAY



This map shows the eight nation television exchange that linked Britain, France, Belgium, Holland, Denmark, Germany, Switzerland and Italy for the first time in the history of TV.

HOW IT WORKS

The conversion process apparently consists in photographing the picture as it appears on one screen, eliminating the line structure as much as possible (which would almost certainly prejudice definition) and retransmitting it under the line structure of the new transmitter.

It is something like making a process block for printing, using another printed picture instead of an original photograph.

The dot structure of such a picture must first be eliminated by photographing through a ground glass screen. Diffusion through the screen removes the dots, but blurs the sharp edges of the image, which is further degraded when the second set of dots is produced during the block making.

Equivalent processes in television may not be as drastic as the above examples, particularly when coming down from a large number of lines to a smaller number. But in principle degradation can hardly be avoided.

FUTURE POSSIBILITIES

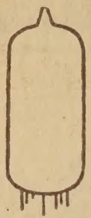
Extension of TV relays throughout the world would be an intriguing business.

The chief difficulty would be in keeping the relay chain unbroken. Long ocean hops would be impracticable. The signals would eventually fade out altogether round about horizon level, and at all costs they must be kept strong and free from interference.

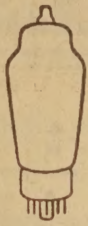
The path to Australia, for instance, would require a long trip down through an island chain and a good deal of luck.

New Zealand would appear to be unfortunate, for it's hard to see how we could span its ocean separation.

But long before we reach that stage, the problem of costs would have to be met. As the links would only be used on certain occasions, their installation and maintenance would be prohibitive until some other regular use could be found for them which would produce revenue.



World Series Television Valves



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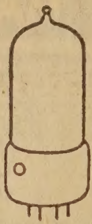

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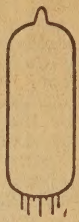

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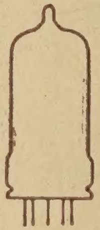

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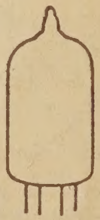

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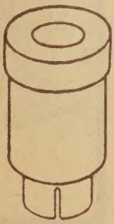

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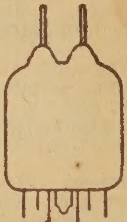

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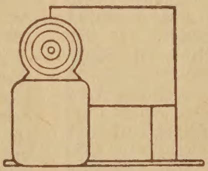

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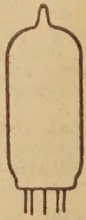

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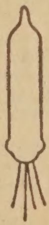

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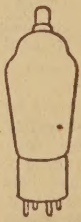

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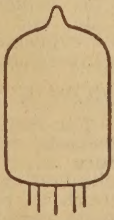

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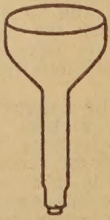

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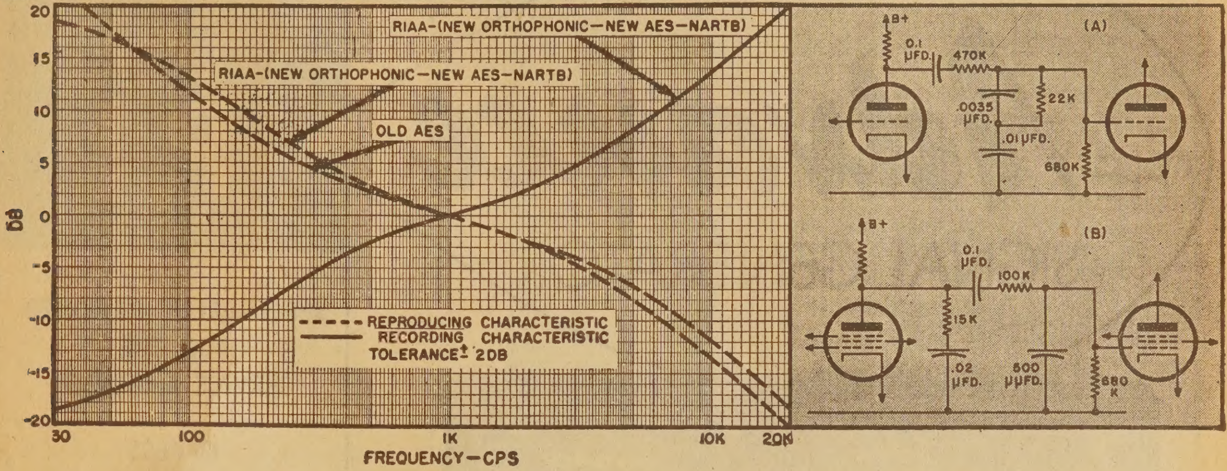
THE NEW RIAA RECORDING CURVE



New RIAA recording and playback characteristics. The triode and pentode amplifier equaliser circuits (Figs. A and B respectively) when used with a high quality amplifier and pickup are recommended by RCA to obtain the desired basic reproducing characteristics. Minor tone-control adjustments may be required to compensate for pickup characteristics.

Standardisation of recording-playback curves for gramophone records seems to have reached some finality with the RIAA curves shown above, and which were mentioned in our last issue. If the record industry as a whole can be induced to use it, the problem of correct compensation will no longer be a problem.

At first sight, the differences between this curve and a couple of others appear so slight that one wonders why another standard was needed at all.

The answer might well be that the best way to persuade companies to adopt a curve is to suggest something which, at least on the face of it, isn't the same as that developed by a competitor

It is one thing, for instance, for Columbia, USA, to say that it will adopt the RIAA curve put forward by the Record Industry Association of America, but quite another to announce adoption of the RCA New Orthophonic curve, even if there is little difference between them.

That isn't a bad example, because of all the curves now used, the RCA is nearest to the RIAA, particularly in the matter of bass roll-off, which most people consider a good thing to reduce motor rumble and other troubles consequent on high bass boost on playback.

THE RESPONSE

As the curve shows, it drops by 13.75 db at 10 Kc, and rises 17 db at 50 cycles, with, however, a roll-off of 3 db at that point. These are playback terms, but the recording curve is an exact reciprocal of it.

For purposes of comparison, the AES curve is shown on the graph together with the new standard. Actually it is within the 2 db tolerance which applies to all curves including the AES, so that the only real difference is in the bass end below about 60 cycles.

Only those control units having an RCA New Orthophonic position will be dead right for the RIAA, although a little bass cut with an AES curve would be reasonable, and perhaps a little treble cut as well.

In other words most control units will be suitable for the new curve by slight trimmings to existing positions.

At the same time, it would be wrong to imagine that we won't get records which will still sound better with additions or subtractions to the set curve. To make it more confusing, several companies have said that re-issues of records already in the catalogues will be made with the RIAA curve, if it is not already in use. So that for all records issued to date, the playback position is largely guesswork.

VARIOUS COMMENTS

In Australia most issues are made on an AES curve or near to it, and it is likely that many are already using a bass roll-off. Here are some American comments also taken from Radio and Television News.

Albert Pulley (Chief Engineer, RCA Victor)—"Of course, the new curve is identical with our 'Orthophonic' which we have been using for some time now." (Incidentally, Mr. Pulley pointed out that Victor records marked "New Orthophonic" on their jackets are not merely cut with the new curve, but are so designated because of all the other factors such as microphoning, &c., which is part of the "New Orthophonic" process). All other new Victor records are cut with the new RIAA curve whether or not they state "Orthophonic" on the jackets. Mr. Pulley also asserted that all replacements and even the "Treasury" series would be cut with the RIAA curve whenever possible.

William Bachman (Chief Recording Engineer, Columbia)—"We are using the new RIAA curve in all new Columbia recordings. All replacements will be cut with the RIAA curve whenever possible."

C. Robert Fine (Chief Engineer, Mercury Records)—Mr. Fine indicated that Mercury would go along with the industry in using the RIAA curve in all new releases.

Remy van Wyck Farkas (Director of Artists and Repertoire, London)—"We have been using the RIAA curve for some months now. Our entire catalogue will be recut with the RIAA curve as soon as stocks of the records with the older curve become depleted."

Capitol has been using the RIAA curve for some time now. Decca and MGM will use the new curve in future releases. All of the smaller companies whose output is pressed by Columbia and Victor will use the new curve.

Notable exception to the almost solid swing to the RIAA curve is Westminster. Dr. Kurt List stated that for the time being Westminster would use the old NAB curve. Dr. List did not elaborate as to why this should be, but you can be sure Westminster has a valid reason, and we predict that they will hop on the RIAA bandwagon before too long.

SOME people have ears sensitive to a wider range of sound vibrations than others. The sounds we hear varies from about 16 cycles a second, almost the deepest note, through 125 cycles a second, the average pitch of a man's voice, to 10,000 cycles, the highest frequency used in high-quality broadcasting. There are many sounds humans cannot hear, yet they are audible to dogs. A special whistle has been produced which produces a very high note. To humans this is audible only as a slight hiss, whereas the dog hears what is apparently a high piercing note, and responds.

THE *Advance* SIGNAL GENERATOR

TYPE P1

SPECIFICALLY DESIGNED FOR THE SERVICE ENGINEER

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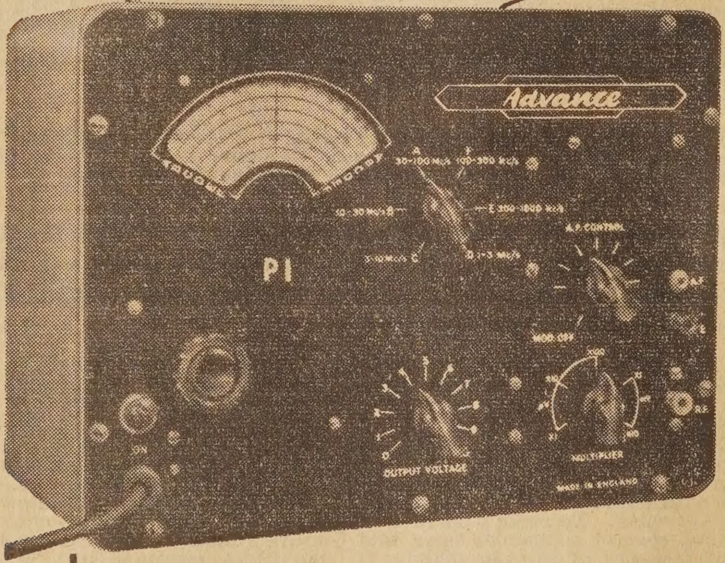

This latest addition to the famous Advance range puts into the hands of every radio and television service engineer a high-grade instrument with an accuracy out of all proportion to its modest price. This has only been achieved by very careful design—employing accepted standard signal generator technique—and by streamlined production methods.

Up-to-the-minute design of the oscillatory circuit and special attention to screening and filtering ensure that even at 100 Mc/s stray field is less than 3 microvolts.

The P1 employs an accurate attenuator system which embodies a non-inductive slide-wire followed by a five-position 75-ohm ladder network. The 75-ohm cable, correctly terminated by the "Advance" TP8 pad, obviates reflections due to mis-match and ensures that the output voltage at the dummy aerial is substantially that indicated by the attenuators.

Price £32/12/6
Plus Sales Tax

SOLE AUSTRALIAN AGENTS

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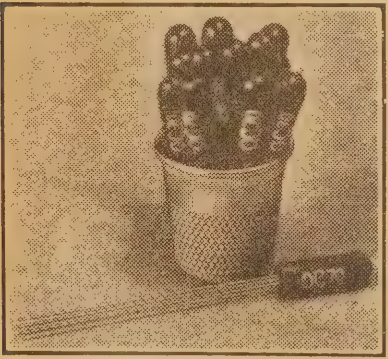
MADE BY ADVANCE COMPONENTS LTD., ENGLAND

HIGHLIGHTS OF BRITISH RADIO SHOW

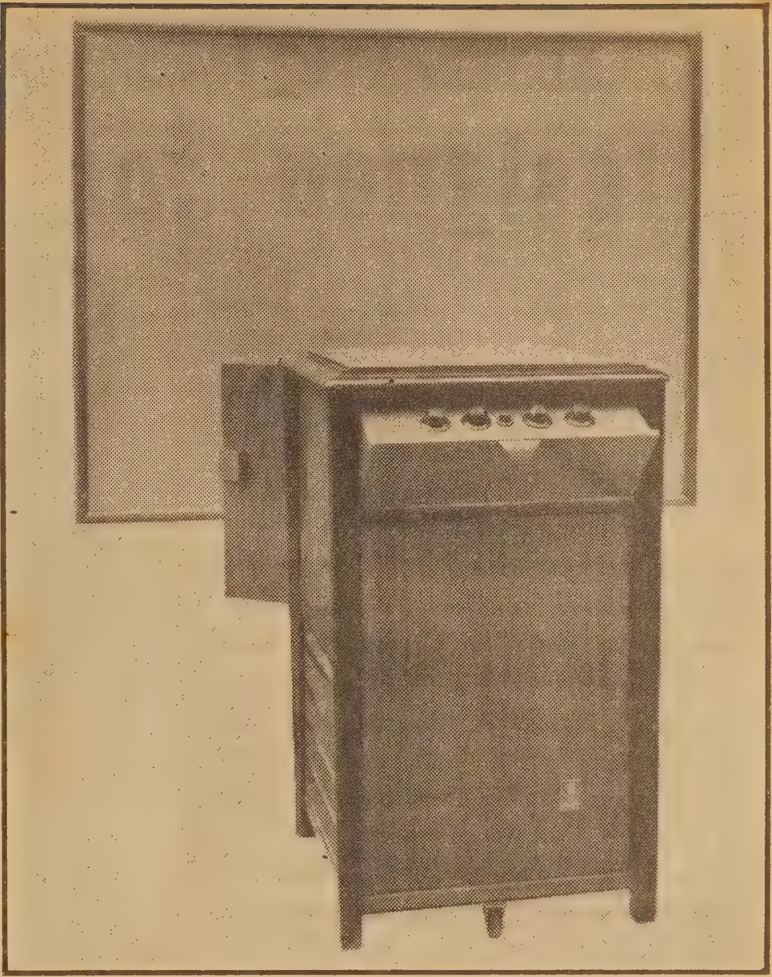
The 21st (British) National Radio Show, held at Earls Court from August 25 to September 4, under the patronage of H.M. The Queen, was the world's largest and most ambitious demonstration of the technique of broadcasting in sound and television.

AT least 55 sound and television programs went on the air from the Show and there were continuous television programs on the closed circuit serving 409 receivers.

Fifteen television cameras, ranging from small industrial types to the roving eye, complete with its own transmitter and power supply, were in operation. A fullsize BBC studio of the latest design was used for major sound and television programs; an indoor grass arena for demonstrating outside broadcasts; a small TV studio for special items; a continuity studio where popular announcers were in full public view; and a dais for interviews with celebrities.



On the Mullard stand were examples of transistors. Twelve Mullard junction transistors are seen here sitting easily in a thimble. They are widely used in hearing aids and special equipment. Mullard makes many types.

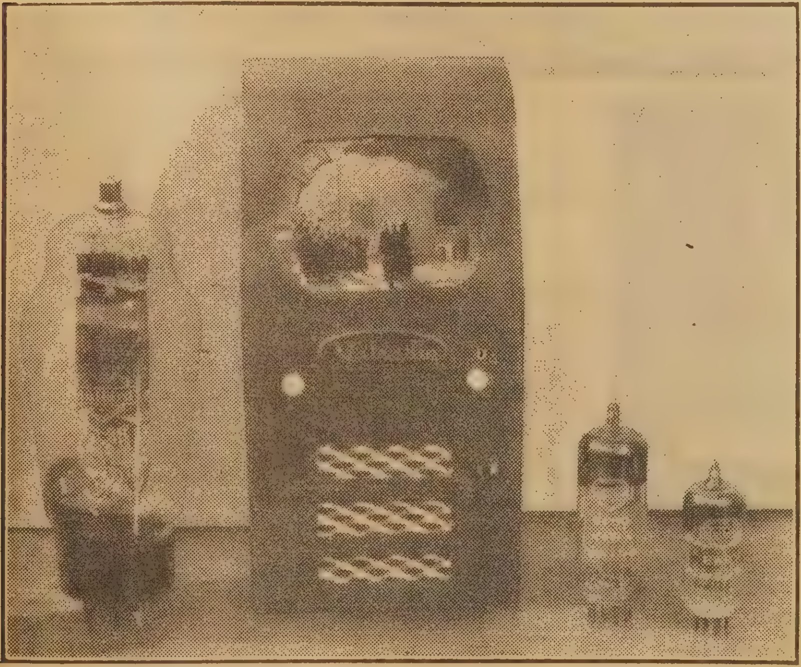


A front projection receiver for TV — the picture size is 4ft x 3ft, with a separate curved screen of processed aluminium. It was made by White-Ibbitson Ltd. and sells at a reduced price of £153 sterling.

ARMY STAND

At an Army stand a recording studio allowed the public to record messages for relatives abroad in any of the three Services and from which the Forces Favorites program was broadcast.

Forty manufacturers exhibited sound and television receivers, including multi-channel sets for the alternative TV programs, and tuner units for them were in production on one stand.

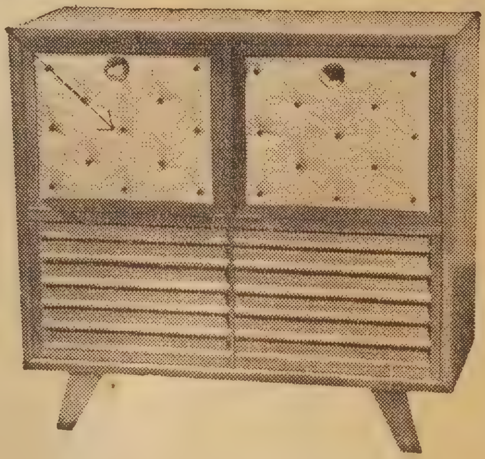


A really small TV set was shown by Valradio. Its picture size is only 2x1½in, and it is seen here with some standard radio valves for purposes of comparison. It is not clear whether this set is available to the public.

AUTOMATIC RADIOGRAMS

Designed for today *

NEW YORKER - C85



*

Nowadays people expect both beauty and utility from their furniture. The Calstan C85 "New Yorker" and C79 "Continental" have that simple yet functional design so popular overseas. Finished in really modern high quality honey-toned maple veneer both models are available with 8, 6, or 5 valves.

Calstan combine all the best features of radio engineering & cabinet craftsmanship.

Special features of the New Yorker—

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- 3 speed automatic record changer — plays 7in, 10in and 12in records.
- Craftsman-built cabinets in finest veneers.

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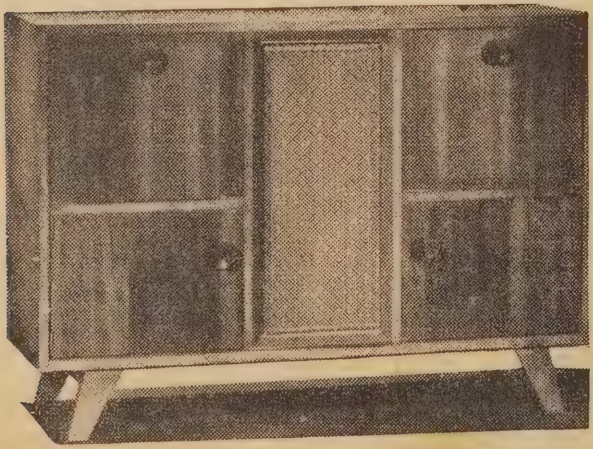
RADIOS AND RADIOGRAMS



CONTINENTAL - C79

Special features of this model—

- 3 speed record changer
- Dimensions: 48in wide x 35in high x 18in deep
- Expanded aluminium grille.
- 2 large storage compartments for records and/or glassware or bottles

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TV SERVICES FROM SPACE SHIP

If an Italian engineer has his way we can expect to be receiving our international television programmes via a station in space within the next 15 years or so.

Dr. G. A. Partel, of Cerva, suggests that the main technical activity of the International Astronautical Federation should be devoted to this end.

HE believes that the television and broadcasting companies throughout the world would be saved enormous expense in the future if they relayed their programs from an unmanned instrumented rocket. This would move around the earth like a tiny man-made moon.

We are familiar with the limited range of television transmitters, and the recent Eurovision link-up needed expensive land-line and repeater station connections. In the United States similar conditions prevail, with 110 broadcasting stations needed to cover the nation.

HEIGHT AND RANGE

Putting television transmitters on the peaks of high mountains improves the range. How much better it would be, says Dr. Partel, if we put the station out in space!

One transmitter could send its programs to viewers over a tremendous area, almost a complete hemisphere of the earth.

Some of the existing television stations would be retained to beam the program to the station in space. There the transmitter would amplify the signals and return them to earth.

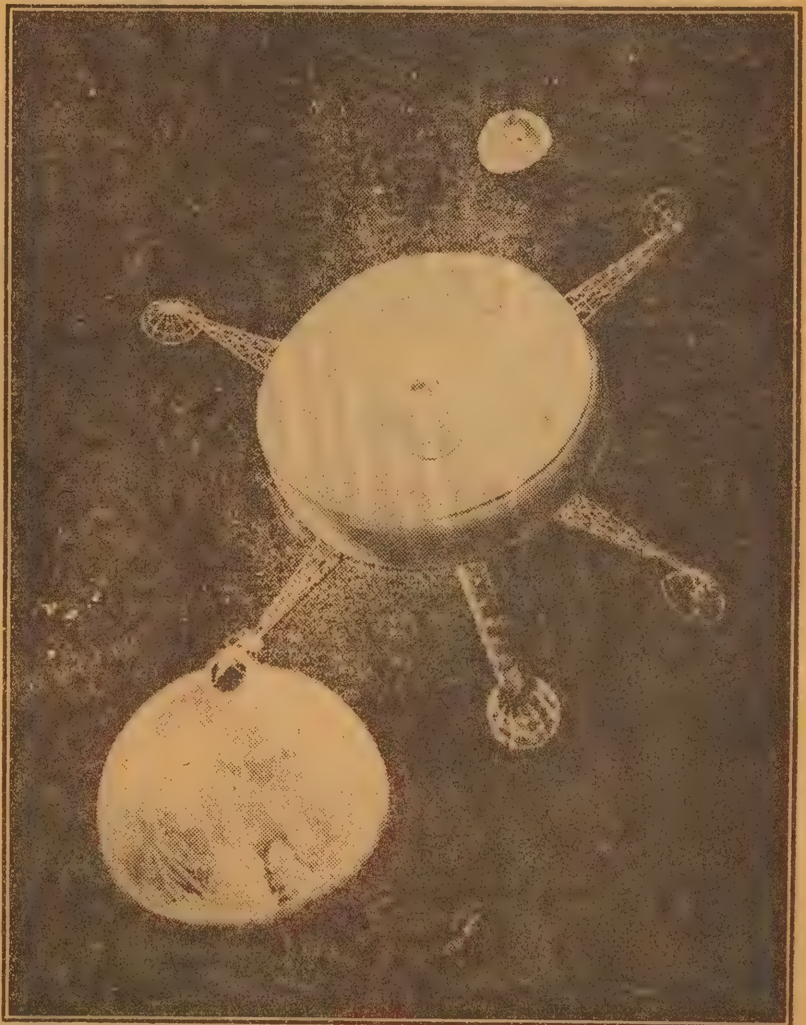
The receiver aerials would be trained on the space transmitter and a great amount of present-day interference would be eliminated. There have even been plans to place the station in what is known as a stationary 24-hour orbit.

It would be at such a distance that it would revolve around the earth once in every 24 hours; that is, in the same time that the earth rotates on its axis. Consequently, relative to the surface of the earth, the satellite station would be still in the sky. It would not rise or set.

LESS INTERFERENCE

The highly directional aerial pointed skyward at the satellite would not pick up interference like the present aerial systems. Mrs. Jones will be able to use her electric hair-dryer whenever she wants without interfering with your favorite program!

Of course, it will need power to radiate the programs from the station in space. The interplanetary scientists have an answer to that. They aim to use the harsh radiation from the sun; out in space, unfiltered by the atmosphere, it is intensely brilliant.



A manned space station circling the earth. Note the great solar mirror picking up the sun's rays for conversion into electrical power, and the aerial masts for the television repeater services. Such stations as this may become a permanent feature of the next century.

They have even calculated how much power they can intercept with mirrors which will concentrate the radiation like monster burning glasses. It will be more than enough for sending the programs to earth.

Even today scientists are working on the development of solar engines. Recently the Bell Telephone Laboratories in the United States announced the perfection of a solar battery. It consists of a lattice of sensitive cells which convert sunlight directly into electric current.

By ERIC BURGESS F.R.A.S.
(Fellow of the British Interplanetary Society)

The whole thing is smaller than a tea tray, and when held in the sunshine it will give sufficient power to operate a walkie-talkie set or a small portable radio.

Other large solar engines are used in some sunny climates to warm oil which, during the cold nights, supplies heat for the domestic radiators. Out in space large areas of cells, suspended on lightweight rigs, because in space all things are weightless, will extend in great wings on either side or around the satellite station and generate enough electrical power for the television service.

If all this comes to pass, we can expect mixing and editing studios sorting news flashes from different parts of the earth, and all situated in the large manned station. But although manned satellite vehicles may be things of the remote future, Dr. Partel said that

SPOTLIGHT
on SOUND
MODEL 12Ux
ROLA

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Power Handling Capacity	12 watts (Peak)
Fundamental Diaphragm Resonance	50 c.p.s. ± 5 c.p.s.
Frequency Response	45-12,000 c.p.s.
Voice Coil Impedance at 400 c.p.s.	8.4 ohms.
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quite simple rocket vehicles could be used for this purpose.

He calculates that by using rocket fuels which have today been developed for guided missiles we could send a three-step rocket into an orbit around the earth where it could automatically carry out the function of a television repeater. Such a rocket might carry a payload of half a ton of radio equipment and weigh some one hundred tons, when it takes off from the earth's surface.

Even manned space stations need not be so costly as has been prophesied. Not so long ago Von Braun put forward proposals for a manned station with a complement of about a hundred men. This needed a large number of freighter rockets, each weighing some 7000 tons at take-off.

THREE-STEP ROCKETS

It was a scheme which made most engineers hold up their hands in horror! Now Mr. K. A. Ehricke, of the Bell Aircraft Corporation, has shown that manned space stations can be established with much smaller tanker rockets.

He visualises three-step rockets weighing only 600 tons at take-off assembling material in space for a four-man observational satellite. Whether or not 600 tons represents a vast improvement over 7000 tons from the engineering standpoint only the guided missile people can tell us.

So far the heaviest rockets are believed to be of about 12 to 15 tons weight, but it is certain that military workers will soon be attempting transcontinental rockets which may turn the scales at 50 tons.

UNMANNED VEHICLES

As far as can be seen at the moment, unmanned vehicles appear to be the logical answer both for television relays and for interplanetary exploration.

As with atomic power, where machines only can enter into dangerously radioactive areas and carry out maintenance and other processes close to the atomic piles, so we shall find that a lot of man's proposed conquest of space will have to take place through robot missiles.

Man himself may have to be content with keeping his frail body where it belongs, protected at the base of the earth's atmosphere, while his probing machines burst out through the ocean of air and radio their data back to him from the depths of interplanetary space.

LIQUID PENICILLIN

IF the doctor wants to give junior penicillin by mouth instead of by injection, or "shots", he can now prescribe a liquid brand that is flavored with butterscotch. While especially likely to please the children, this new penicillin can be given to grown-ups, too.

Besides the greater convenience, giving penicillin by mouth is said to lower the number of hypersensitivity, or allergy, reactions to the famous mold remedy. The butterscotch-flavored job is now being distributed by Parke, Davis & Company, Detroit, who give it the brand name, Penasoid Suspension.

PALOMAR MAPS THE UNIVERSE

The most extensive map of the universe ever attempted is taking shape on Palomar Mountain in California. Astronomers are systematically photographing the heavens out to a distance unmatched by any previous such survey. They have just completed their most successful winter's work. The first section of a history-making sky atlas is scheduled for publication in 1955.

Hundreds of large photographic plates, taken in pairs in red and blue-filtered light, are being fitted into this atlas. Section by section, the tremendous sweep of space visible from the latitude of Palomar is being recorded.

FIFTH ANNIVERSARY

In the fifth year of the work, better photographic materials and long periods of good weather aided progress. Twice as many acceptable plates were made as in the previous best year. The survey is building toward an eventual total of 1758 plates, or 879 pairs.

Palomar Observatory's "Big Schmidt," a 48in wide-angle telescope camera, is being used for the mapping project. Following the large-scale charts thus made, the giant 200in Hale telescope at Palomar then can be aimed at pin-point areas of the sky to study particular features with greater light-gather-

With this telescope team, astronomers probe fantastic distances. Stars, galaxies, clusters of giant nebulae, space dust and gas are being recorded out to an average distance of three sextillion miles (3,000,000,000,000,000,000,000).

Never before has such a comprehensive mapping project been attmpted on the visible universe. When the atlas is finished, it is expected to furnish astronomers with enough new material for a century of study.

In the distant depths of the sky, the project is continuously discovering new aggregations of stars and systems of stars, nebulae like the Milky Way.

Not only systems or clusters are being found, but clusters of clusters.
Begun in 1949

BEGUN IN 1949

The Sky Survey is jointly sponsored by the National Geographic Society and the California Institute of Technology, which operates Palomar Observatory. Begun in 1949, it may not be completed until 1957 or later.

From the Survey's discoveries and the overall sky atlas — already dubbed by astronomers their "portrait of creation" — will come new opportunities for science to learn more about the scope of the universe, its possible beginnings, and the timeless unfolding of the birth and the death of stars.

MICRO WAVE RADIO POTENTIAL GIANT

An electronics infant that has already grown to be a husky youth is expected to grow to giant size. This potential giant is microwave radio.

MICROWAVE operates on frequencies far higher than those used in ordinary radio. The microwave beam travels along a narrow path like a searchlight beam. Because of the earth's curvature, it must be relayed between towers placed 15 to 30 miles (24 to 48 kilometers) apart.

Because the beam is focused so narrowly, a microwave transmitter needs very little power — only about as much as that required for a small flashlight. Even so, some microwave communications systems can handle more than 400 messages at one time.

INDUSTRIAL NEEDS

Microwave's ability to carry many electronic messages on one channel makes it highly effective for industrial needs. The communication may be a conversation, a teletype message, an electric meter reading or an electronic impulse that opens and closes a valve. To microwave, there is no difference between a television broadcast and an interoffice message.

Microwave's high frequency makes it free from interference and static that disrupt some radio communications. Microwave beams can cross each other without interference.

Microwave also plays an important part in the broadcasting of television programs. Of the 52,000 channel-miles (a channel-mile is one channel one mile long) of television relay in operation in the United States today, some 33,000 miles are microwave.

USE FOR RAILROADS

Many believe that railroads may be the next big users of microwave in maintaining reliable communications between control offices and trains. Severe storms sometimes disrupt the present wire communications used by the railroads.

Microwave may also be used in these ways: On express highways to aid in traffic control; in industrial television, where remote cameras have to be connected to central observation boards; for theatre television, to link theatres with stadiums, auditoriums or other places from which broadcasts are being transmitted.

Microwave radio does break down, but through automatic devices the exact spot of the break — and often the exact cause of trouble — is immediately known. This means that repairs usually can be made much more quickly than on a wire line.

Sherlock Holmes, classic sleuth of fiction was advanced in his day, but modern methods have left him far behind. But today's mircoscopes are only extensions of his magnifying glass; and highly developed apparatus allows us to make better use of the clues he valued.

NO MYSTERY ABOUT DETECTION

Among the many scientific aids to crime detection, chemistry, physics and medicine play a very important part. When used in crime detection, they are prefixed by the term "Forensic" —and this will be our topic for the month.

by Calvin Walters

MYSTERY stories of the more advanced kind usually make some effort to bring these sciences into the picture but, owing to the rather technical nature of the subjects, detail is usually lacking.

The "scientific bureau" is a most necessary establishment in modern criminal investigation departments. It is usually a modern, well-equipped laboratory presided over by qualified scientists of the highest standing and ability.

FORENSIC CHEMIST

The forensic chemist is probably the most important man in the group for he must deal with matters which are often purely chemical by nature, such as determining by analysis the composition and quality of many different substances.

Then again, he must be proficient in the examination of questions which are partly chemical, partly physical and partly medical, such as the examination of counterfeit coins, fabric and textiles, blood, documents and so on.

In previous articles I have dealt with such matters as fingerprints and the use of ultra-violet x-rays and infra-red rays in the realms of crime detection. I therefore do not propose to refer to these subjects here but to concentrate mainly on the work of the chemist.

To begin with, we will choose the matter which lies nearest the heart of the inveterate reader of murder stories—bloodstains.

When any one is murdered there is usually large quantities of blood be-spattered around the room or other surroundings. It is therefore most important that the victim's blood should be subject to analysis so that any suspect covered with blood should be either pinned down as a potential murderer or proved innocent. He may merely be a butcher on his way home from work, a doctor going home from an operation.

Collection of the various samples is carried out by the police and the articles sent to the laboratory for examination.

The characteristics of the victim's blood are usually determined first. After that it is generally a matter of determining whether stains on clothing subsequently found belonged to the victim. Blood may be found on all manner of articles in the immediate vicinity such as carpets, floor, walls, furniture, knives, paper weights and so on.

Some of this may belong to the victim and some to the murderer who may have been injured during the struggle.

The first thing is to decide whether in fact the stains are really blood stains or stains caused by fruit juice, rust, paint, coffee, dye or many other substances.

FIRST TESTS

A preliminary test is first made. This determines whether the stain is likely to be blood or not. This test does not give absolute proof that the stain IS blood but excludes a stain as not being blood. A confirmatory test is then made, followed by a test to determine the origin of the blood.

The preliminary test consists in applying a chemical to the stain and noting any color change. The reagent used for this is usually a mixture of sodium perborate, benzidine, and glacial acetic acid.

When this solution is applied to a stain a deep blue coloration will result if blood is present.

The next stage, the confirmatory test, begins with a microscopic examination for red blood corpuscles. This test is often used to differentiate between blood from man and animal. The red corpuscles stand out vividly under the microscope in the case of fresh blood but, when blood has dried, it is difficult to make a decision by this method.

The second confirmatory test is more accurate and consists of mixing the suspected stain with glacial acetic acid, sodium chloride or sodium iodide on a glass microscopic slide. This is heated until the solution boils. The slide is cooled and examined under the microscope, when the presence of blood is proved by the formation of long, narrow, thin, rhombic crossed-over plates of a dark brown color. These are crystals of a chemical called haemin and the crossed-over formation is most characteristic.

SPECTROSCOPIC TEST

A third confirmatory test which gives decisive results is the spectroscopic test. With this test all derivative of haemoglobin (the red coloring matter in the blood) shows distinctive absorption bands in the spectrum.

To carry out this test, the specimen, suitably treated with a reagent, is placed on a microscopic slide and examined through a microscope, whose eye-piece has been replaced with a special spectroscopic fitting. A bright light is passed through the specimen from beneath and the characteristic spectrum shows up clearly.

The final test for the origin of the blood depends on a most peculiar property. If a living animal, over a period of several days, is injected with small quantities of blood serum either animal or human, the animal's blood serum will acquire the property of producing a precipitate when it is mixed with the blood of the same kind of animal used for the original injection.

Theoretically, it is possible to subject every kind of animal, bird and fish to this injection process, collect the serum and form a library of blood serum which could be used to determine exactly which animal a sample of blood belonged to.

This is not necessary as it is only necessary to distinguish between the blood of animals of close relationship. Dog and fox blood give similar reactions and are called "canine". Sheep and goat blood are called "ovine", cow, ox and buffalo are called "bovine" and any kind of bird blood is called "avian".

It is therefore necessary to have only several kinds of serum in stock and these are obtainable from various sources.

PRECIPITATION

For the test, the sample of blood is mixed with distilled water and thus made into an extract. This is treated in various ways and the correct acidity or alkalinity obtained. When ready the extract is filtered and made perfectly clear.

Under perfectly controlled conditions the blood is divided into several parts and the blood serum from the various groups added. The mixture is allowed to stand for a few minutes and examined. Any precipitate which forms in one of the tubes indicates that the specimen of blood being tested belonged to a human being, canine, ovine, bovine avian, and so on.

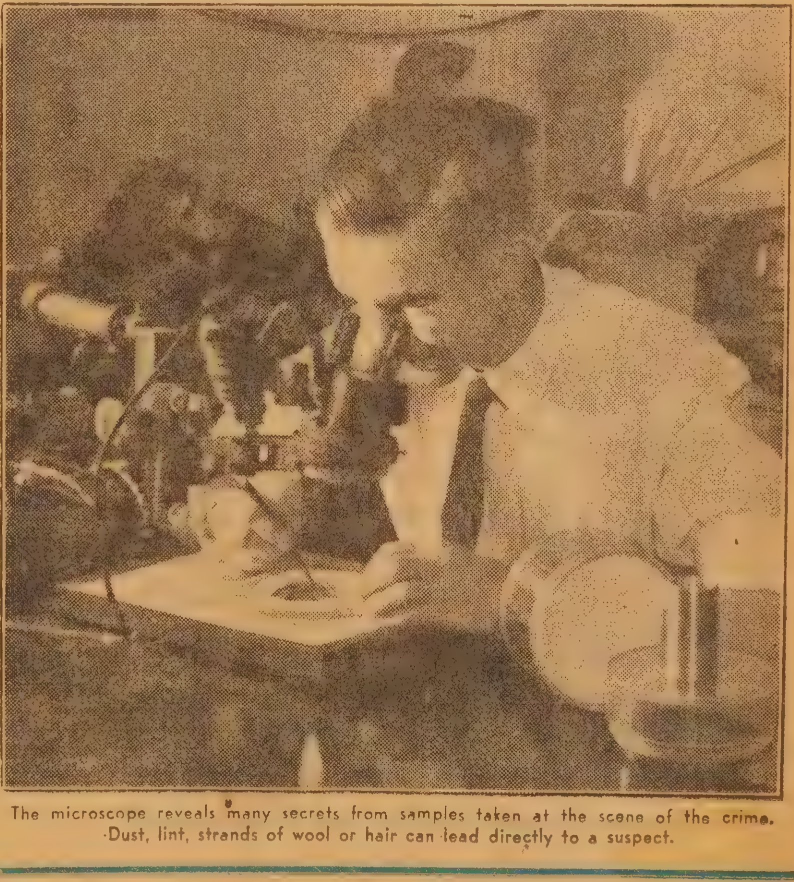
Many other stains beside blood need careful testing in certain cases For example, acids are used in the making of explosives and the forgery of banknotes during the process of etching plates.

Suspects' clothing and implements which require testing are usually confiscated. Any patches showing stains are removed and the stain extracted with water.

A piece of litmus paper pressed to the patch will determine whether

SLEUTH VACUUMS FOR CLUES

Many valuable clues have been extracted from the cuff of a man's trousers. The same device seen here can take samples of dust from clothing, carpets, rugs etc for later examination. It is like a small vacuum cleaner.



The microscope reveals many secrets from samples taken at the scene of the crime. Dust, lint, strands of wool or hair can lead directly to a suspect.

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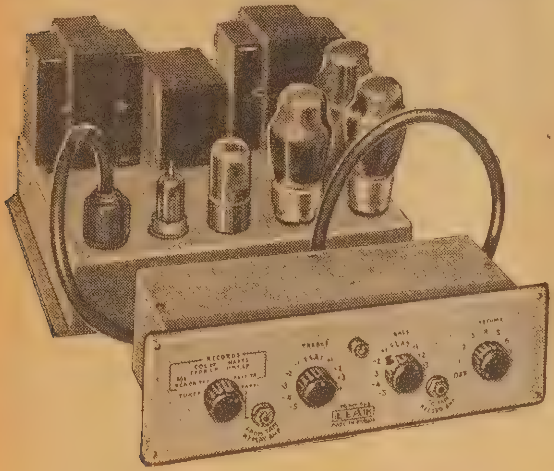

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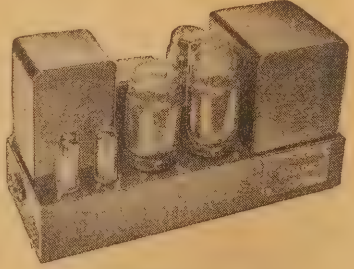
- All Types Microphones



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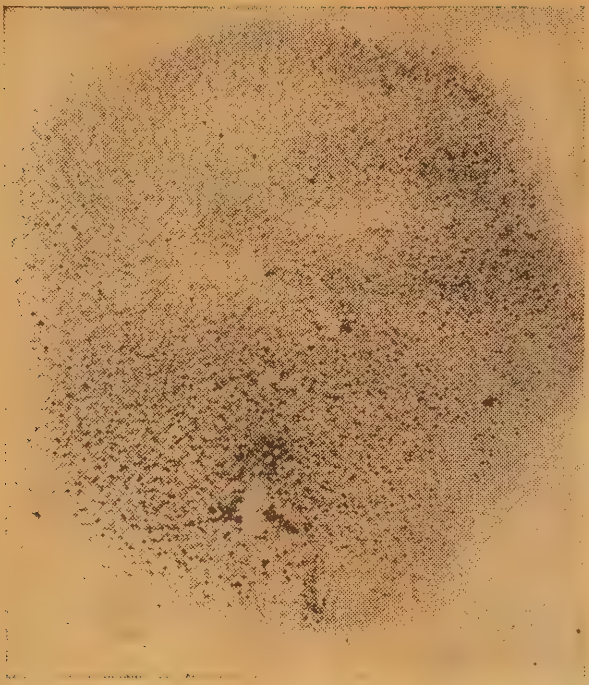

A precipitated blood sample as described in the article can show that the sample came from a specific animal class.

No precipitation means that the sample and the test serum came from a different class of animal.

it is acid or otherwise. Litmus paper turns red with acid and blue with alkali.

ACID TEST

The test for sulphuric acid is to add a solution of barium chloride. A white precipitate will be formed which will not dissolve in hydrochloric acid. This acid is used for making explosives and for throwing over people you don't like.

Nitric acid is used by forgers for etching plates used to print banknotes. Picric acid is also used for making bombs.

Space does not permit of further detail regarding the manner of testing all stains. There is a tremendous variety of which the chemist must have a complete knowledge. Oil and grease stains, fruit juices, paint, rust, wine and beer, shot marks, human and animal secretions, dyes and so on, all have to be tested on various occasions, according to the type of crime being investigated.

The chemistry relating to documents is a life study in itself. The manufacture of inks and their analysis demands great ability. The composition of paper in its endless variety and the chemicals used by forgers to remove ink marks from paper require first-rate knowledge.

Forensic medicine is another branch of science which demands great skill on the part of the practitioner, as any error could upset the whole of a case against the suspect or render an injustice to the innocent.

One of the most important aspects of crime dealt with by the medical specialist is the establishment of death and the time of death. There is, in existence, a popular fallacy which states that certain forms of coma can simulate death so completely that even the most expert doctor can be deceived.

This is not so, and the many signs of death can provide absolute evidence that death has taken place.

These indisputable signs are: Cessation of the circulation of the blood; breathing stops; muscles become flaccid; lower jaw drops; eyelids remain open; pupils are dilated and the cornea becomes dull. The skin becomes inelastic; the body gradually cools off; muscles become rigid. The rigidity spreads over the body and then disappears after a time. No state of coma can imitate these symptoms.

A saucer of water placed on the chest will indicate cessation of respiration by the absence of ripples. Lack of pulsation at the principal arteries indicates cessation of circulation and therefore stoppage of the heart beat. No body can live and not breathe. No body can live without the blood circulating and the heart beating. No matter how weakly one breathes or the heart beats, it can be detected.

FINAL EVIDENCE

There are changes which take place after death, which could not occur in a living body. These are valuable evidence as to time of death, the position in which the body has lain, whether the body had been moved after death and whether injuries had been inflicted before or after death.

There are very significant changes in the blood after death which are of the greatest importance from the legal aspect.

Before the blood coagulates it tends to drain to the lowest part of the body. This influx of blood enlarges the fine capillaries, thus bringing about a discoloration which is known as postmortem lividity.

DISCOLORATION

To the unitiated these could be mistaken as having been caused by violence. The stains are very distinct about six hours after death. They are valuable in determining how the body was lying either at the time of or soon after death took place. They will not appear on those parts of the body in contact with the surface on which it lays. It is, therefore, obvious that if death had occurred over six hours before the body was found, any lividity showing on the part in contact with the surface on which it lay will indicate that it had been moved after death.

Authors of detective stories both in book form and in films have one favorite topic for the detective. He will usually ask the medico "How long is it since the time of death?"

This is a most important point and worthy of some detail as to how it is arrived at.

The answer to the question is usually framed so as to give only an approximation, such as death has occurred not less than so many hours ago.

One of the first indications is the temperature of the body. Normal body temperature is 98.4 degrees. When death occurs the body cools to the temperature of the surroundings. This cooling takes place during the first few hours at the rate of about two degrees per hour. Afterward the rate is about 1½ degrees per hour. From this knowledge the examiner can make an approximate calculation by working backward

(Continued on Page 112)

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Technical Review

CHARACTRON TUBE HAS MANY COMMERCIAL USES

For use in electronic computers and similar equipment there has recently been developed a version of the cathode ray tube which is able to reproduce any letter or figure, or combination of them in sequence, simply by the application of suitable deflection voltages. The image so produced may be located on any desired part of the screen.

THE device is known as a charactron and is similar to a conventional cathode ray tube in that it has the usual cathode and gun assembly to provide a stream of electrons and a set of horizontal and vertical deflection plates to control it.

However, here the similarity ends. Following the deflection plates is a plate set at right angles to the electron beam and having punched in it openings corresponding to the letters and figures to be reproduced. This plate is known as the matrix and up to 100 characters can be accommodated on one matrix.

The electron stream from the gun is focused rather broadly so as to adequately cover each opening in the matrix and the beam may be deflected to pass through any opening simply by applying suitable voltages to the horizontal and vertical deflecting plates. The result is an enlarged image of the matrix opening on the screen of tube.

To locate the image at any desired position on the screen a second set of deflection plates are fitted, after the matrix, and suitable voltages are applied to them. Additional focusing electrodes are also located after the matrix so that the image can be adjusted for maximum sharpness without affecting the coverage of the matrix opening.

COMPUTER SIGNALS

In use it is only necessary to arrange that the output of a computer of any kind be in the form of suitable deflection voltages in order to have the tube display the answers to calculations as fast as they can be delivered.

In fact the device is capable of reproducing up to 10,000 separate characters per second and is thus suitable for receiving data at high speed over landlines or radio channels. Obviously data displayed at very high speeds must be recorded, generally on some form of photographic film or paper.

A suggested use for the charactron is in conjunction with guided missiles, where it is vitally important to have a continuous flow of data regarding speed, angle of flight, direction, &c., and from which the location may be determined.

This is usually obtained either from data transmitted from the missile itself or by tracking it with radar. However, the speed at which these devices travel makes it impossible to make direct use of this data and it is normally fed to computers which calculate the required information continuously.

Any device which enables this information to be presented rapidly and in a manner which is easily read and understood by the operators will obviously improve the efficiency of the system, and the charactron would seem to be a natural choice.

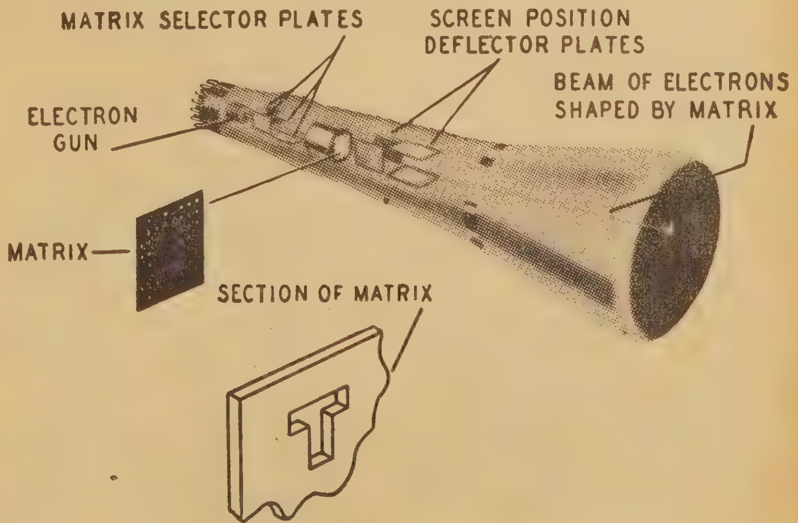
PRINTING MACHINES

Charactrons with standard alphabetical and numerical matrices are being used in xerographic high speed printing machines. Here their purpose is to reproduce visual images on light-sensitive surfaces, so that words and figures can be permanently developed and transferred to paper. Messages and data thus printed may come directly from a remote transmitter or from an automatic filing system, wherein various types of information may have been recorded on magnetic tape.

When operating at top speed, a set-up of this type is capable of decoding numerous types of input signals and translating them directly into words and figures that can be printed continuously in small type at a rate of 20 square inches of paper per second.

NEW COLOR CAMERA TUBES

The RCA Company has announced an image orthicon color TV camera tube. Known as type 6474, it is exceptionally sensitive and it is capable of good resolution. Its spectral response approaches that of the eye. When using a suitably designed optical system and efficient color filters the color camera can obtain commercially acceptable color pictures with about 350 foot-candles of incident incandescent illumination on the scene and a lens stop of f5.6.


MATRIX SELECTOR PLATES
SCREEN POSITION DEFLECTOR PLATES
BEAM OF ELECTRONS SHAPED BY MATRIX
ELECTRON GUN
MATRIX
SECTION OF MATRIX

In addition to the conventional cathode and electron gun the charactron has a punched matrix and an extra set of deflection plates. These enable the image of any matrix cutout to be located on any part of the screen. The tube is capable of reproducing 10,000 images per second.

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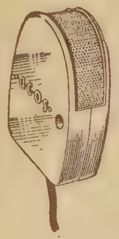

MODEL 35
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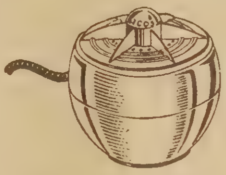
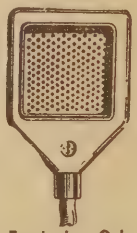
PRICE £2/15/-

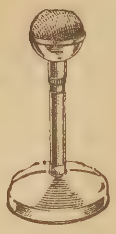


MODEL 33
(DESK)
PRICE £6/18/6

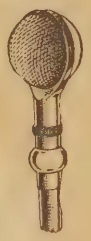


Front view Only

MODEL 28
(LAPEL)
PRICE £5/19/6



MODEL 22
(HAND/DESK)
PRICE £9/18/6



MODEL 16
(HAND/FLOOR)
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TECHNICAL DATA SHEETS GLADLY FORWARDED ON REQUEST

"ACOS" CRYSTAL MICROPHONE INSERTS

MIC. 3 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.3-2	General Purpose	1¾in dia. x ⅜in thick	20db Peak at 2500 C.P.S.	Mona	£1 19 3
MIC.3-5	" "	" " " " "	12db " " " "	Mervyn	1 19 3
MIC.3-6	" "	" " " " "	5db " " " "	Myrtle	1 19 3

MIC. 6 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.6-4	General Purpose	2 1-32in dia. x 19-32 thick	20db Peak at 2250 C.P.S.	Margie	£1 19 3
MIC.6-6	" "	" " " " "	5db " " " "	Maudie	1 19 3
MIC.6-11	" "	" " " " "	12db " " " "	Mandy	1 19 3

MIC. 14 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.14-5	General Purpose	1 7-16 dia. x 11-32in thick	20db Peak at 3500 C.P.S.	Maxie	£1 19 6
MIC.14-11	" "	" " " " "	12db " " " "	Mitchell	1 19 6
MIC.14-12	" "	" " " " "	5db " " " "	Malcolm	1 19 6
MIC.15	Hearing Aid	0.9in dia. x 0.155in thick	30db " " 3000 "	Marlene	1 19 6
MIC.17	" "	15-16in sq. x 7-32in thick	30db " " 3500 "	Maggie	1 19 6
MIC.18	General Purpose	1 7-16in dia. x 9-32in thick	20db " " " "	Maisie	1 19 6
MIC.19-4	" "	1 ¾in dia x 13-32in thick	Flat from 40 to 6000 CPS	Merry	1 19 6

MIC. 23 SERIES

TYPE	DESCRIPTION	DIMENSIONS	RESPONSE	CODE	PRICE
MIC.23	General Purpose	1 3-16 sq. x ¼in thick	20db Peak at 3000 C.P.S.	Maureen	£1 19 3
MIC.23-3	" "	" " " " "	5db " " " "	Margaret	1 19 3
MIC.23-4	" "	" " " " "	12db " " " "	Milton	1 19 3
MIC.32	High Quality	1 13-16 dia. x 9-16in thick		Martin	2 15 6

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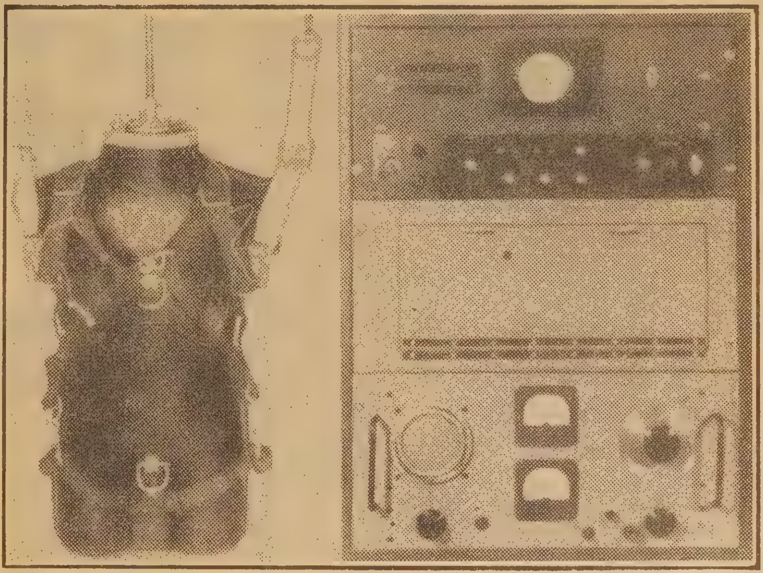
AN ELECTRONIC PARACHUTE TELEMETERING SYSTEM

A parachute telemetering system recently developed by the USA National Bureau of Standards is facilitating tests of experimental parachutes for use with modern high-speed aircraft. Electronic equipment mounted inside a parachute-borne torso-shaped dummy transmits by radio needed information—altitude, and forces at various points—in coded form to a ground station where the information is decoded.



Left: Airborne unit of the NBS parachute telemetering system is housed in a torso-shaped dummy to which the test parachute is attached. Right: Ground station consists of a 217-megacycle FM receiver (bottom), 16-millimetre oscillograph camera (centre), and subcarrier demodulator and monitoring oscilloscope (top). The output of the ground station is a continuous film record of sequentially sampled unbalance signals from eight resistance bridges in the airborne unit.

MILITARY parachutes have been required in steadily increasing numbers in recent years for military aviation. Parachutes for emergency use must be of improved design, if they are to withstand the severe pull encountered upon opening after ejection from modern aircraft. Furthermore, the opening shock must not be so great as to injure the jumper. In addition to their usual function of enabling personnel to descend safely from disabled planes in emergencies, parachutes have now become an important tactical device for delivering men and equipment.

The development of safe parachutes to meet these various requirements calls for more complete knowledge of the strains produced in parachute shrouds and canopy and of the forces acting on the jumper or load. This parachute development is greatly aided by equipment for making remote measurements on test-dropped dummy-carrying parachutes.

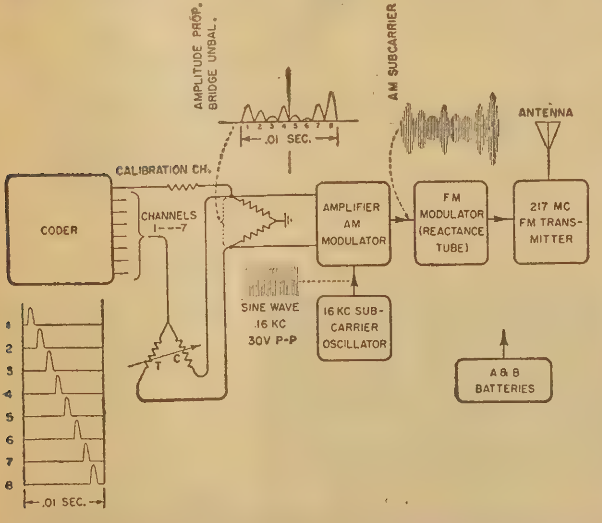
STRAIN GAUGES USED

In the NBS parachute telemetering system, resistance strain gauges are arranged to sense both altitude (pressure) and the tension in various harness straps. An inductive-commutator arrangement excites one strain gauge at a time, the output of the gauges being combined to modulate a small battery-powered radio transmitter. Seven measurement channels and a calibration channel are provided.

At the ground station, a spot on the face of the cathode-ray tube moves up and down with the amplitude of the modulating signal. This spot is recorded on continuously moving photographic film. The film record is then transcribed, using a semi-automatic film reader, to obtain plots of altitude versus time and harness tension versus time.

The airborne part of the system is designed for ruggedness, low cost, and medium accuracy. Ruggedness is necessary because the period of maximum shock, when the parachute is opening, is the period for which measurements are most important. Low cost is desirable because, with experimental parachutes, occasional losses of equipment are to be expected. Medium accuracy—of the order of 10 per cent—is sufficient, since the phenomena being measured are not reproducible with high uniformity.

The airborne transmitter operates on 217 megacycles and has an output of about 0.75 watt and a range of about 2 to 10 miles. Seven valves are required for the entire airborne unit. The battery pack, which provides 7.2 volts at 1.0 ampere and 190 volts at 80 milliamperes, is tailored for about an hour of service.



The tensiometer which senses forces in the parachute harness is an H-shaped steel structure to which resistance-wire strain gauges are cemented. Gauge resistance is 15,000 ohms, and the maximum useful change which harness tension produces is about 7.5 ohms. The altimeter consists of an evacuated bellows, which responds to changes in air pressure by deflecting a thin cantilever beam carrying resistance strain gauges. As both the tensiometer and the altimeter are linear to better than 5 pc. point-by-point calibration is not needed.

Modulation of the transmitter with the signal from one channel at a time is accomplished by means of a "coder" of novel design. The coder supplies a series of time-sequential pulses to eight resistance bridges—one for the altimeter, one for each of the six tensiometers, and one fixed bridge for calibration. One hundred pulses per second are received at each bridge.

AMPLITUDE MODULATION

The bridge-unbalance signals are first amplified and then converted to amplitude modulation of a 15-kilocycle subcarrier. This subcarrier in turn frequency-modulates the 217 megacycle transmitter by means of a reactance-tube modulator. A flexible transmitting antenna projects from the top of the dummy that houses all of the electronic equipment.

The ground-station receiver gives an output that is identical to the amplitude-modulated 15-kilocycle subcarrier in the airborne unit. Demodulator and filter circuits convert this output signal to a waveform

(Continued on Page

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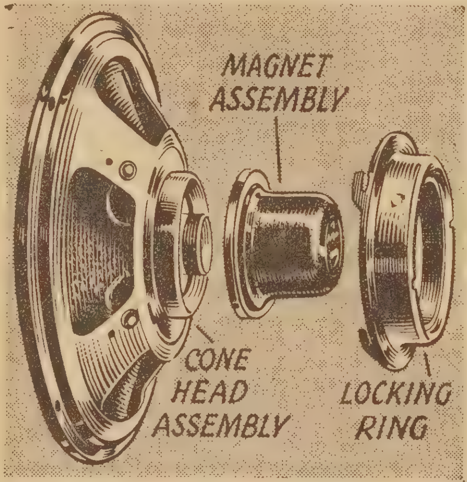

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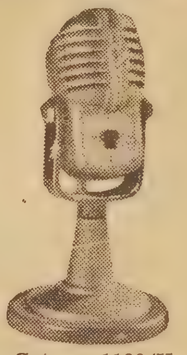
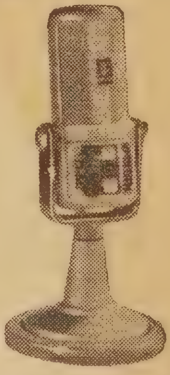


Cat. 1100/V; Swivel cage crystal type with volume control £8/1/6.



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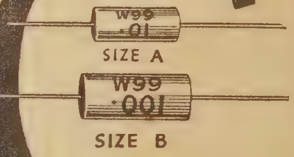

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GEIGER COUNTER USES NOVEL HIGH-TENSION SUPPLY

Readers who are keen on experimenting may like to try out this circuit for a very simple Geiger counter. Featured in the latest issue of Radio & Television News, it is described by Dr. Harry Fechter of Stamford Research Institute and Dr. M. R. Boyd, of General Electric Research Labs.

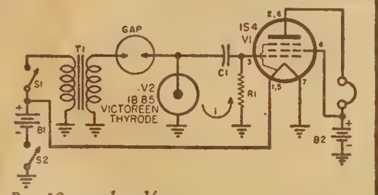
THE article assumes the use of a particular type of Geiger tube but there appears to be no obvious reason why the instrument could not be built around one of the less expensive, low voltage units available locally.

The whole success of the unit depends on using a high quality storage capacitor and achieving extremely low leakage across the high tension circuit. This alone makes it feasible to operate from a manually generated high tension supply. The complete text of the article reads as follows:

Occasionally one has need of a simple, convenient counter to get a qualitative idea of the presence of radiation. On the other hand, one may be interested in the Geiger counter as a system.

This counter may be built inexpensively from parts found in most experimenters' homes.

We have used this counter to measure activity in the experimental physics area at the Hansen-High-Energy Physics laboratory (Stanford University) after conducting electron scattering experiments. It has also been an interesting companion on several prospecting trips.



R_1—10 megohm, 1/4 w. res.
C_1—.05 µfd., 600 v. cond.
S_1—Microswitch (or equivalent)
S_2—S.p.s.t. toggle switch
T_1—Universal type output trans. 5000 to 8000 ohm pri. to 4 to 8 ohm sec.
B_1—1½ v. flashlight cell
B_2—22½ v. hearing-aid battery
Gap—See text and Fig. 4
1—Headphone
V_1—1S4 tube
V_2—1B85 thyrode (Victoreen)

Here is the complete schematic diagram of the Geiger counter, its simplicity being obvious. The circuit should work with any low voltage Geiger tube but extreme precautions must be taken to avoid leakage across the HT circuit and consequent rapid discharge of the storage capacitor.

There are several unique features of technical interest (Fig. 1). The high voltage supply uses a minimum of parts.

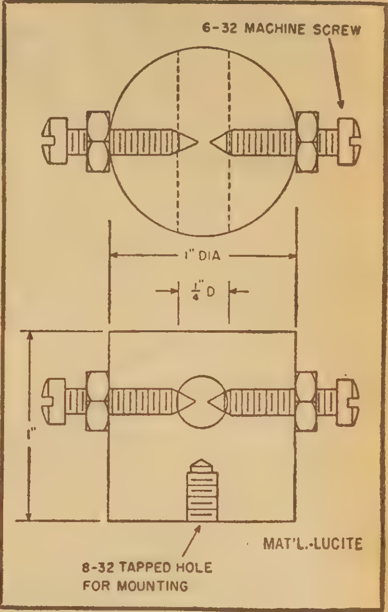
It is built with a Microswitch (or equivalent), an ordinary speaker output transformer, an easily-made spark gap, and a 1.5 volt flashlight cell which is also used to heat the amplifier filament.

With simple mechanical switching it delivers 700 to 1000 volts for the Geiger tube. The substitution of manpower for expensive batteries is a special convenience if one is using the counter for prospecting.

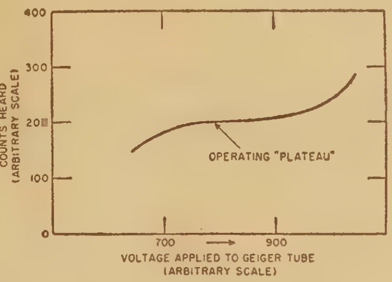
The spark gap construction is somewhat arbitrary. We found it convenient to cut an inch of lucite from a 1in diameter cylindrical rod.

A quarter inch hole in the side allowed room for the gap which was made by tapping in at right angles to the quarter inch hole for two 6/32 bolts.

The 6/32 bolts were filed and stoned to pinpoint sharpness (see Fig. 3). The points are set about .2mm apart, but this adjustment is not too critical and should be experimented with. The base of the lucite cylinder is tapped for mounting.



Mechanical details of the spark gap.



Typical operation curve for a Geiger tube. The voltage has to be "pumped up" to plateau level, then kept there by occasional operation of the switch.

To operate, one closes the Microswitch 10 or 12 times.

The large induced voltage in the secondary of the output transformer breaks down the gap and adds charge to the condenser C1 at each switching. This gap action is also self rectifying and we thus eliminate a rectifier tube.

One listens in the phones for the appearance of counts either from cosmic ray mumesons, or electrons, or the gamma rays from a watch with a luminous dial.

The charging process is discontinued before the voltage builds up beyond the Geiger plateau (see Fig. 2). If the tube is over-voltaged, one hears many more than normal counts during the charging.

Repeated over-voltage shortens the tube life or damages it. The condenser C1 is fairly well isolated on the Geiger tube side and the charge in it will now run the counter from 5 to 30 minutes, depending on the quality of components and, somewhat, on the humidity.

An occasional push on the Microswitch will allow operation to continue. C1 is a .05 mfd, 600 volt Sprague unit; the tube socket is Isolantite.

When a particle passes through the counter, a current flows in the direction of the arrow (Fig. 1) and a fairly loud click is heard in the phones.

The counter can be housed in any convenient way, keeping the high voltage circuit well insulated from other parts. It can be built in a very small space if desired.

IMPROVED RURAL TELEPHONE

EAVESDROPPING on rural telephone party line conversations may become a thing of the past if experiments meet the expectations of Bell Telephone Engineers.

The engineers plan to try out a transistorised telephone system that will permit several conversations to be carried over a single line without mix-up. As a by-product, eavesdropping will go.

The principle is already used on long distance telephone networks. However, until the tiny transistor was developed—making it possible to do the job electronically at a fraction of the usual cost—the method was uneconomical on a local basis. Now engineers believe they can make transistors work economically on lines as short as five miles.

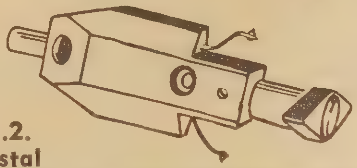
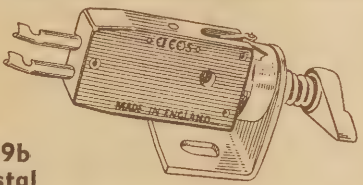
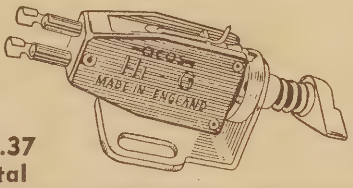
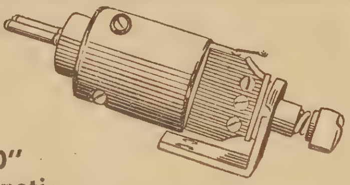
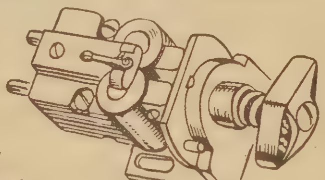
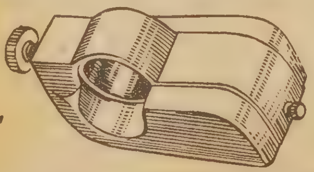
When Mrs. Jones calls Mrs. Smith, the conversation will be transmitted on the line at one frequency. If Mrs. Brown, who shares Mrs. Jones' line, decides at that moment to call the grocer, her conversation will be put on another frequency.

The callers will not have to worry about getting on the right frequency. This will be taken care of automatically by the tiny battery-powered transistors mounted on the telephone poles. The conversations will be sorted properly at the line's terminal.

Bell telephone engineers worked out the system in collaboration with five operating telephone companies and the Western Electric Co.

PRICE LIST 1954/55

PICK-UP HEADS and CARTRIDGES

TYPE NO. & ILLUSTRATION	APPLICATION	DATA	PRICE
 **T.C.2.** Crystal	● MONARCH CHANGER ● B.S.R. GU4c units ● Goldring Turnover Pick-up etc.	OUTPUT: 1 volt Frequency Range 30-7,000 Styli — S8	**60/-**
 **GP29b** Crystal	● B.S.R. Units GU.4 ● Stromberg Carlson Changer (Velvet Action) ● Garrard etc.	OUTPUT: .75 volt Frequency Range 40-8,000 Styli — S7	**60/-**
 **HGP.37** Crystal	● MONARCH CHANGER ● IMPORTED CHANGERS ● AUSTRALIAN CHANGERS	OUTPUT .6 volt Frequency Range 30-10,000 Styli — S16	**60/-**
 **"200"** Magnetic	● Goldring Magnetic Turnover Pickup ● MONARCH CHANGER ● B.S.R. unit GU4M	OUTPUT .5 volt Frequency Range 40-6,000 Styli — S10	**60/-**
 **"500"** Magnetic	● VARIABLE RELUCTANCE PICKUP No. 500	OUTPUT 10 millivolts Frequency Range 20-16,000 Styli — S20	**£5/5/-**
 **"185"**	For adapting acoustic gramophones to electrical reproduction.	OUTPUT .5 volt Frequency Range 50-6,000 Stylus — standard gramophone	**£2/5/-**

GOLDRING CARTRIDGES and PICK-UPS are available from leading Radio Houses.

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GOLDRING ENGINEERING (AUST.) PTY. LTD.

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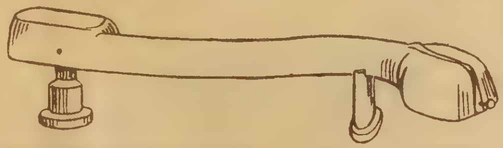
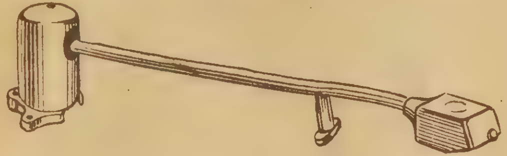
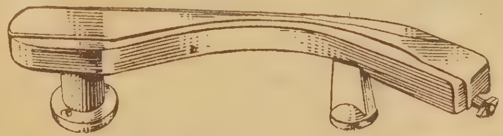
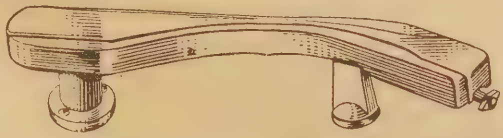
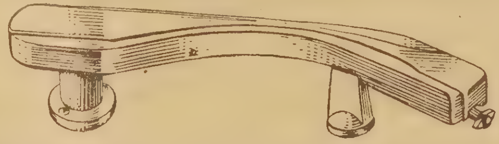
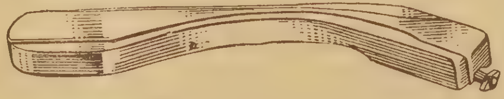
PRICE LIST 1954-55

PICK-UPS

COMPLETE WITH
CARTRIDGES

TYPE No. & ILLUSTRATION	APPLICATION	DATA	PRICE
"137" 	For single speed record players requiring magnetic pick-up with good output.	OUTPUT: .5 volt Frequency Range 40-6,000 STYLUS: S6	£ 2'8'6
"125" 	Lightweight pick-up for good quality reproduction. Single speed only.	OUTPUT: .2 volt Frequency Range 30-7,000 Stylus: S/3	£ 3'0'0
TURNOVER MAGNETIC 	Fully tropicalised magnetic pick-up with high output. 3 speed.	OUTPUT: .5 volt Frequency Range 40-6,000 Styli: S10	£ 4'15'0
TURNOVER CRYSTAL 	Crystal Pick-up using Crystal turnover cartridge. 3 speed.	OUTPUT: 1 volt Frequency Range 30-7,000 Styli: S3	£ 4'15'0
VARIABLE RELUCTANCE 	Variable Reluctance Pickup of highest known quality. 3 speed.	OUTPUT: 10 millivolts Frequency Range 20-16,000 Styli: S/20	£ 7'10'0
UNIVERSAL ARM 	Owners of GU.4 units, who wish to instal the latest cartridges, can easily replace the GU.4 arm with this new universal arm. It will accommodate all cartridges with ½" mountings as listed opposite. No technical skill required. Just push out pivot pin to replace arm, and unsolder pick-up leads.		16'-

Ask for Special Descriptive Leaflets. There's a Goldring Quality Product for every requirement . . . Goldring specialise in sound reproduction.

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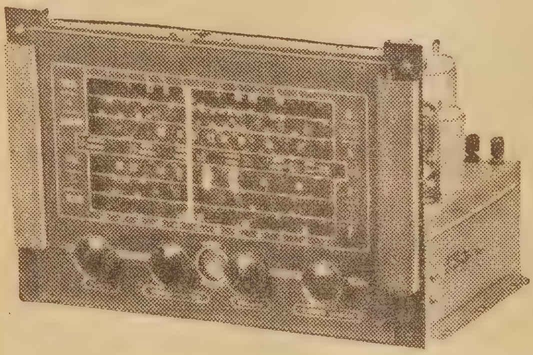

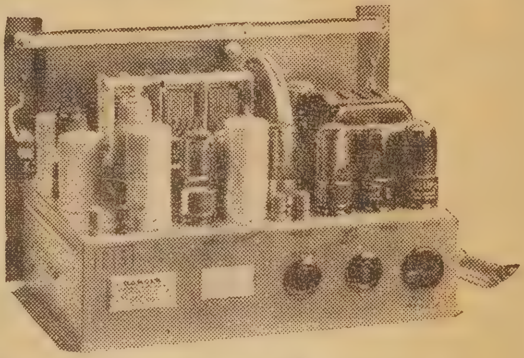

COMPARE THESE FEATURES

- Ultra modern circuit with new high gain valves and permatuned iron cored coils and intermediates giving good interstate reception and a short wave range of 12,000 miles.
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- All chasses are wired for the fitting of an F.M. or Tape Recorder. Special plug on back of chassis being provided, also standard 3-pin socket for power supply to motor.
- Speakers supplied are Magnavox 12in and 8in permanent magnet with tropic proof transformer.
- Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations in each State in prominent type, fitted with counterweight drive and indicator lights on dial showing which band in operation.
- Dial can be supplied in cream or brown with matching knobs and escutcheon to suit blond or walnut cabinets.

ALL CHASSES CARRY SIX MONTHS' GUARANTEE.

A New 10-Valve Dual-Wave Radiogram Chassis

The ideal chassis for those difficult locations where reception is doubtful

Specifications as nine valve unit but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

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We have a complete range of 3-speed record playing equipment, including B.S.R. or Garrard Players, with turn-over crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new B.S.R. 3-speed changer that will play 7, 10 or 12in records intermixed. All changers have turn-over Crystal pick-ups.

CLASSIC RADIO

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NEWS AND VIEWS OF THE MONTH

Sound fights pain

AMERICAN scientists are easing the pain of arthritis with ultrasonic sound waves.

They reported "strikingly successful" results with similar treatment of bursitis and rheumatism.

The sound waves are of such high frequency that human beings cannot hear them.

Alternating electric currents vibrate special crystals hundreds of thousands or millions of times a second to produce the waves.

The waves penetrate the body at distances up to several inches, compressing and expanding the tissues.

The patient's cellular tissues are given a "powerful micro-massage".

The scientists met recently in Washington to report on their work in ultrasonics.

Dr. K. Woeber, of Bonn, Germany, said ultrasonics had proved useful in treating skin cancer in white rats.

He said he was able to cut the amount of harmful radiation used in the treatment by combining x-rays with ultrasonic waves.

★ ★ ★

Vertical flight

BRITAIN has produced a freak in jet planes—it can rise directly into the air like a helicopter.

It has no wings and no rotor (as the helicopter has).

Supply Minister Sandys described the plane at a dinner of the Society of British Aircraft Constructors.

Mr. Sandys said the plane weighs 3½ tons.

It had its first tests a few weeks ago and flew successfully for about 10 minutes, and landed without trouble.

It lifts itself into the air by downward-facing jet streams, which can be varied to control the angle of climb.

"I can hardly call it an aircraft, for it is really no more than an aero engine with a pilot mounted on top," Mr. Sandys added.

★ ★ ★

Atom waste problem

BY the year 2000 AD the oceans of the world will be too small to contain all the radio-active waste from the world's atomic power plants, according to Professor T. G. Hunter, Professor of Chemical Engineering at the Sydney University.

The disposal of atomic waste products on land would be dangerous because eventually all would find their way into water and the sea.

Overseas estimates were that by 2000 AD the world's atomic power plants would generate 2,200,000 megawatts of electricity.

Australia's present electric generating capacity is 2581 megawatts.

The atomic power plants of 2000 AD would produce about three tons a day of highly radio-active fission products, probably in the form of liquid waste.

This liquid waste would amount to about 6-million gallons a day.

To dilute this waste to safe tolerances would require huge quantities of water.

Dilution to safe strengths of the radio-active strontium waste alone would require about 26-million cubic miles of water—a fifth of the world's oceans.

Another 13,000 cubic miles of water would be needed to dilute radio-active cesium waste, 7800 cubic miles for zirconium waste, and 6600 cubic miles for cerium waste.

Professor Hunter considers that possibly the best solution would be to absorb the waste in clays and convert the clays into glass, which could be stored safely.

This would require establishment of a vast new industry.

US radar islands

A VAST chain of huge radar islands in the Atlantic Ocean is planned by the US Air Force.

The islands will warn the US land bases of a possible sneak attack by an enemy. They will be built ashore, then towed into place by tugs.

Once in position, they will be raised in the same manner as offshore drilling platforms.

The islands will be as far as 125 miles to sea, and each of the towers would cost £334,000.

Mechanical donor

PATENT and manufacturing rights for mechanical blood transfusion apparatus developed by a Melbourne doctor have been given to the army.

Described as a "life-saver", the machine takes blood direct from the donor to the patient.

Made of metal, it is the size of a small cigar box, and can be clamped to any firm object like a table.

It was developed by Dr. Mark Ashkanasy, of Carlton, and Mr. G. Johnston, of Preston, who worked on it for two years.

The director-general of Army

POPULAR SCIENCE QUIZ

Q.: How many active volcanoes are there in the world?

A.: Geologists say there are about 450 active volcanoes in the world today and any one of them is capable of destructive eruption. Some volcanoes, such as Krakatoa, Vesuvius or Kilauea in Hawaii, are watched closely and geologists have learned to spot some of the danger signs that help to warn of impending eruptions.

Scientists at the Bandung Vulcanological Station on Java usually visit Krakatoa every month or so on inspection trips. They have learned that a danger sign for this volcano is the boiling of the water once occupied by the central portion.

Even though volcanoes usually erupt with tremendous force, geologists consider them as "surface" phenomena because the origin of their heat and other energy is at the most 25 to 30 miles below the surface of the earth.

Despite the energy released by the largest man-made explosion, the hydrogen bomb, it does not measure up to that which has been, and still can be, released by a single large volcano.

Q.: What is "piperazine"?

A.: A recently discovered drug which may prove of immense benefit to severely-burned persons is called "piperazine". Its full chemical name is 1-ethanesulphonyl-4-ethyl-piperazine hydrochloride.

In laboratory experiments with white rats, the drug will save up to 100 pc of animals in shock from severe burns while of animals equally badly burned and shocked but not receiving the drug, only 35 pc to 45 pc survived. Earlier studies showed that the drug would help dogs survive shock due to loss of blood.

The drug has not yet been tried in human patients suffering from burn shock, although simple piperazine has been used in treating gout and patients suffering from too much uric acid in their blood.

Q.: What are three methods of changing sea water to fresh water?

A.: Three methods being investigated in California, USA, are solar distiller, power plant and distiller and triple effect distiller.

The solar distiller unit consists of a black tray containing sea water and roofed over with inverted glass plates. Visible sunlight passes through the glass and the solar radiation is absorbed by the black tray to be re-emitted as warming radiation. This infra-radiation cannot pass back through the glass and is thus trapped in the still to raise the water temperature. The roof of the still is cooled by circulating air and when the water vapor strikes it, it condenses and trickles down the inside into wooden drain troughs.

In the second method, warmed sea water is put in a vacuum chamber to speed up evaporation and the resulting water vapor is passed into a condenser, where it is converted into water droplets.

The triple-effect distiller uses waste heat from a diesel engine. It has been suggested that heat wasted in the cooling towers of industrial plants could be used to distill water.

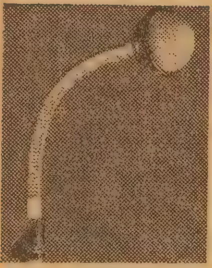
However, at the moment, authoritative opinion is that none of the methods is economical.

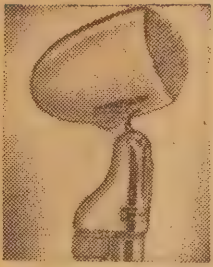
SWITCH TO AWA

PUBLIC ADDRESS MICROPHONES

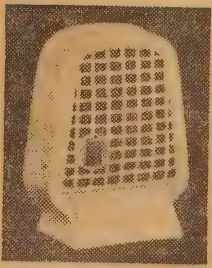
A.W.A. Ronette Crystal Microphones and Accessories

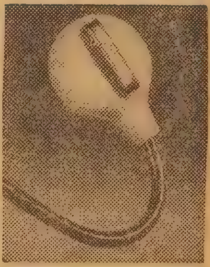
AWA RONETTE

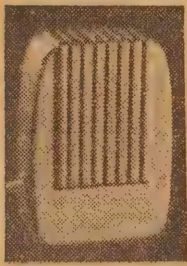

088/F. Filtercell, omnidirectional, with flexible chromium plated suspension.


GS210 and GS210/L. Streamlined, chrome finish, filtercell, high or low impedance.

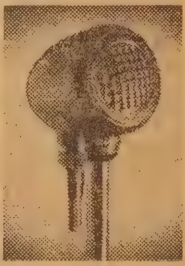
FF2-OV, FF2-P. "Fonofluid" turnover crystal pickup with alternate response characteristics.

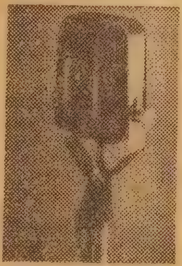

44. Hand or desk mounting, counter balanced base, ivory plastic housing


K407. Contact microphone for attachment to musical instruments — also used as throat microphone.


HM7. Hand or stand microphone, filtercell, robust diecast housing attractively finished.

S742. Duo cell, omnidirectional, suitable for cable suspension.


B110. Plastic torpedo form.


R474. Studio type, 4 cell, omnidirectional.

R572 and R572/L. Studio type, duo cell, omnidirectional, high or low impedance.

RFC and RFC5/L. Single cell semi-directional, high or low impedance.

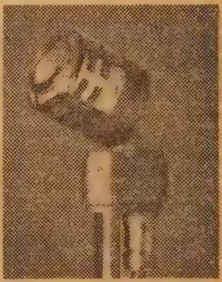
C53. Hand or stand, omnidirectional, black plastic housing and hand grip.

AWA *Reslo*

An extensive range of A.W.A. Ronette and Reslo microphones is available for all requirements.

RVA and RVH. High quality ribbon velocity available in high or low impedance.

URA/S and URH/S. Ribbon velocity with sliding type muting switch. High or low impedance.


PGD and PGD/H. Dynamic with metal diaphragm. High or low impedance.

AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED

47 YORK STREET, SYDNEY, BO233. 167 QUEEN STREET, MELBOURNE, MU9161.

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NEWTON McLAREN LTD., ADELAIDE. NOYES BROS. (MELBOURNE) LTD., HOBART AND LAUNCESTON.
CHANDLERS PTY. LTD., BRISBANE. NICHOLSONS LTD., PERTH.
ALSO FROM LEADING WHOLESALERS

Medical Services (Major-General Kingsley Norris), said recently the machine would save many lives.

It had great possibilities for mass emergency transfusions for victims of radio-active burns in an A-bomb attack.

Army Minister Francis has accepted the free offer to the army of all rights for the machine.

* * *

Atom submarine

THE US Navy will commission the world's first atom-powered submarine, the Nautilus, on September 30.

First sea trials for the craft will follow in a few months, according to United Press reports.

Nautilus will be able to sail submerged around the world without refuelling and the Navy expects it will be able to travel underwater as fast as many surface ships.

After first diving trials, in a few months, Nautilus, a 2800-ton, 30-foot craft, will go into the Atlantic Ocean for deep sea tests.

The navy will take over Nautilus at the Groton (Connecticut) shipyards, where it has been under construction for more than two years.

Navy officials have said Nautilus is the first of a whole fleet of atom-powered ships.

Three other submarines with nuclear propulsion have been authorised and one, Sea Wolf, is being built.

RADIO and Hobbies has a staff vacancy for a young technical journalist with a good background, and the ability to handle projects and write technical articles on radio. Prospects are good for the right man. Apply in writing with copies of references to the Editor, Radio and Hobbies, 60-70 Elizabeth Street, Sydney.

Fast flight

A TAA Convair last month flew 629 miles between Adelaide and Canberra in two hours five minutes.

The plane maintained an average speed of 297 miles an hour.

At one stage the Convair reached a speed of 370 miles an hour while flying at 21,000 feet.

* * *

Car goes sideways

MR. Harry Ferguson, former tractor magnate, intends to manufacture a motor-car which can travel sideways.

A prototype of the car has been built and is now undergoing tests.

All four wheels can be steered, so that it can be driven sideways into the kerb for parking.

It is amphibious and built to travel over any type of rough country.

On good roads it is fast and comfortable.

The car has an independent suspension an all four wheels and an engine mounted in the rear.

In Britain it is expected to cost £1000 (A.£1250).

'NOVA'

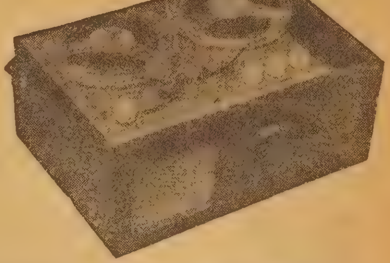
THE ONLY

THREE Speed

KITSETS—HEADS—

DECKS—RECORDERS

in Australia



(7½-3¾-1⅞in/sec) of highest fidelity and professional standard. Excellent musical reproduction at 3¾in/sec (up to 5500c/s) and at 1⅞/sec (up to 3500c/s) will give up to

4 HOURS ON 1200ft. TAPE.

NOVATAPE '54'

½ Track Standard Record and Erase Heads, New **HUM REDUCED DESIGN** (Guaranteed Lowest Signal to Hum Ratio). £4/19/6

For Low Speed—Hi-Fidelity Recording and Playback on 3-Head Recorders. The Special .00025in Gap Head.

Further Details on Application.

Special **magnetic heads** in miniature with film guide **for 8, 9, and 16mm Film SINGLE SCREW MOUNTING, £7/9/-, including Shield.** REMEMBER:—'NOVA' is the **ONLY** firm making **commercial** tape-equipment, used in recorders and Tape-grams available to the self builder in Kitform.

TELEPHONE AMPLIFIER

(as per R. & H., Feb., 1954)

Parts, Kitset and completely assembled.

Coil:—Mu Metal strip, coils, mounting bracket 19/-. Completely built-up, 27/6. Relay switch, 14/6. Attractive sheetmetal case, new small design, £3.

THE NEW LOW VOLTAGE

PHOTOFLASH

Described in R. & H., April-May.

Case, Condenser, Sieflash Tubes, Batteries, Trigger Transformer, Double Anodized Reflector, Neon, etc. Operation from DRY BATTERIES, MAINS OR 4V ACCUMULATOR. Available separately, in complete kitform, or built-up.

TRANSFORMERS

From Little Hearing-Aid Transformers to the ORIGINAL 'WILLIAMSON' or 'LEAK' on English, 28A Supersilcor.

NO JOB TOO SMALL! NO JOB TOO LARGE!

All types of transformers to our customer's specifications, VARIABLE TRANSFORMERS, RE-WINDS.

Terms on low deposits.

HURRY!! THERE ARE STILL SOME BARGAINS LEFT!!

'NOVATAPE' offer a selection of items at Reduced Prices. Demonstration **RECORDERS, DECKS, MODELS, HEADS, MOTORS, PARTS.**

These are definitely worth the money and are released to the readers of 'R. & H.' at Greatly Reduced Prices to make room for more stock for our ever-increasing production.

PLEASE SEND ENVELOPE WITH 3d STAMP for **DETAILED LIST.** All items must be sold immediately.

For further details
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M2159 — — M2350
OPEN SAT. MORN. &
WEEKDAY NIGHTS.

CUT OUT HERE

10/54

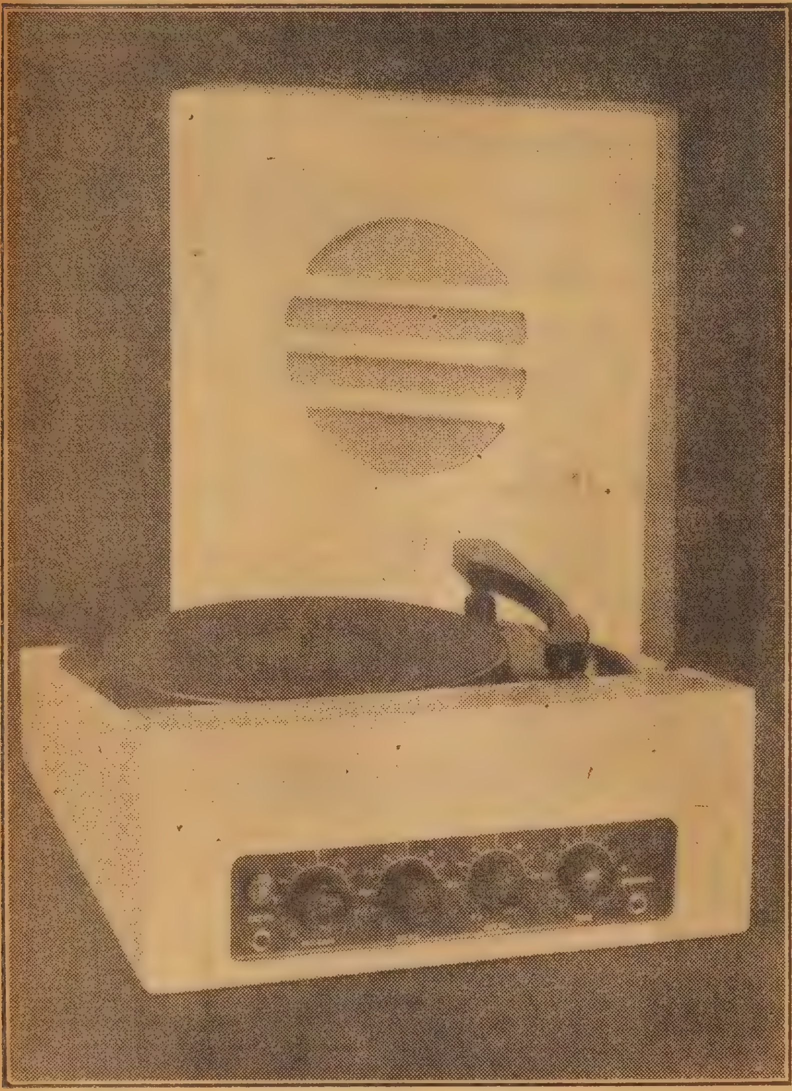
Please send without further obligation, details of ....

NAME ....

ADDRESS ....

....

I enclose LARGE self-addressed envelope and 6d in stamps.



A general view of the complete unit. The speaker is housed in the top half of the case and the amplifier, motor and pickup in the lower half. The pickup and microphone inlets are on the left of the panel followed by the "Mic. Gain", "Int. P.U.", "Ext. P.U.", and "Tone" controls in that order. The speaker outlet is on the extreme right.

THE GP JUNIOR AMPLIFIER

Here is a simple amplifier which will have many uses, hence the name "General Purpose". Intended mainly as a companion to your movie or still projector, it can also be used as a conventional record player, small PA system, or to turn on an impromptu "radio play" at a party.

by Philip Watson

ANY amateur projectionist of either movies or color stills will appreciate the need to accompany a screening with a well-spoken commentary and appropriate music.

Such a presentation makes all the difference between a mediocre amateurish entertainment and one which has all the smoothness, polish and showmanship of the professional theatre. Indeed, if the job is really well done, it can bind together a series of otherwise vaguely connected still slides so effectively that, not only will they tell a complete story, but they will tell it so smoothly that even the absence of movement will largely be forgotten by the audience.

Similarly, a series of movie scenes which can appear horribly flat and uninteresting when screened without sound of any kind will become really lifelike when relieved by a musical background and well-spoken commentary. Since most amateur movies are of the documentary type rather than straight-out fictional drama, they seldom need anything more than this to put them on a level with their professional counterparts.

There are many ways in which we can tackle this problem. An obvious method is to use a tape recorder, and those fortunate enough to possess one can usually turn out a first-class "sound track". The ability to rerecord when necessary is one of the strongest features of these devices, since mistakes can be corrected and sections rerecorded until the finished product is well nigh perfect.

"STRIPED" FILMS

Of more recent origin is the practice of "striping", i.e., the process whereby a narrow magnetic track is painted on the edge of the film, thus providing it with all the features of a tape recorder, plus the automatic synchronisation ensured by having both sight and sound recorded on the one medium.

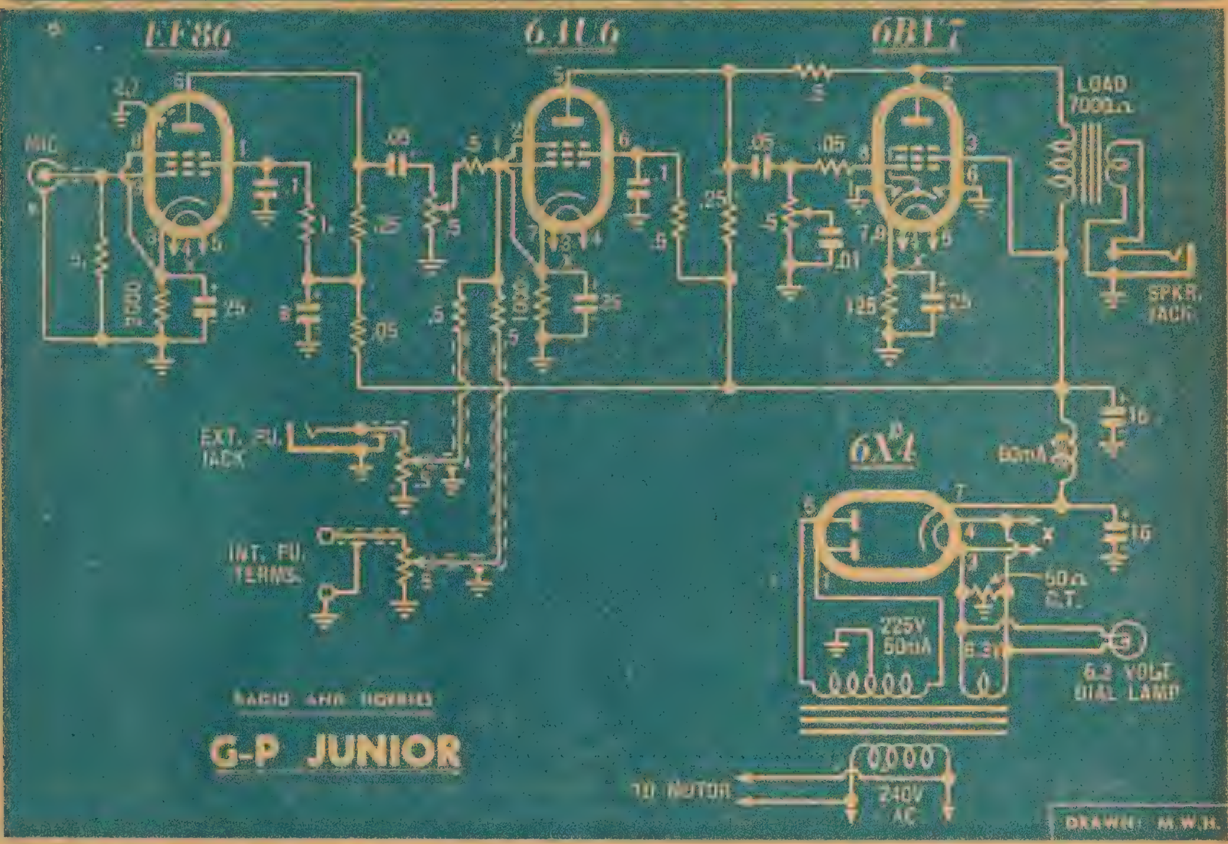
But tape recorders cost a lot of money, as do projectors equipped to handle striped films, and there are many enthuiasts who just cannot afford this kind of outlay, at least not immediately.

It is for these that we have produced this amplifier. It was felt that a small amplifier, capable of operating as a low-power public address system, and with facilities to mix two pickup channels with the microphone, could be a solution to the problem.

For one thing, a commentary emanating from a speaker near the screen and even a little louder than a normal voice is much more forceful and compelling than the unaided voice from the back of the hall. When we add to this some appropriate background music, which may be changed as desired to suit the mood of the picture, we come very close to fulfilling all the sound requirements of such a system.

With these requirements in mind we set out to produce a suitable

CIRCUIT HAS THREE INPUTS AND SIMPLE MIXER



The circuit is a fairly straightforward affair, the main features being the mixing circuit for microphone and two pickups and the use of the low noise EF86 valve as the microphone amplfiier. Note the centre tapped filament circuit and the single earth point for the EF86 input.

amplifier. We decided to present it as a complete unit, consisting of the amplifier proper, a single turntable and pickup, and a speaker, all housed in a suitable carrying case.

In this form it is capable of doing an effective job, especially if used with a few suitable LP discs.

For more elaborate presentations another turntable may be taken along in a separate case and fed into the second channel.

TWO SECTIONS

The cabinet is made in two sections, cut diagonally, one half housing the amplifier, turntable, and pickup; the other half, the speaker. In use the two are separated and the speaker section stood on end near the screen. It is large enough to provide a reasonable baffle, considering the type of work involved.

In considering the amplifier proper, we decided that a great amount of power would not be needed for work of this kind. We based this on the assumption that it is intended for use mainly in the home or a small hall and that the music is intended only as a background. Since the speech also needs only to be at conversational level, it is possible to make very good use of a couple of watts.

By operating the 6BV7 at something lower than its maximum ratings it is possible to use a smaller and cheaper power transformer and filter choke, thus making possible a worthwhile saving in both cost, weight, and space. As it is, the valve is rated to deliver about three watts with the conditions we chose, though naturally not all this will reach the speaker.

To offset speaker transformer losses, we used one of the larger types as normally supplied with the heavier eight in. speakers.

To drive the 6BV7 we used a 6AU6 and, in the grid circuit of this valve there are three .5 meg potentiometers, isolated from each other by three .5 meg resistors. Two of these pots. act as gain controls for each of the two pick-ups, while the third takes its signal from the plate of the microphone pre-amplifier stage. Thus the level of all three channels may be controlled independently and mixed as required. There is no appreciable inter-

PARTS LIST

- 1 Chassis 12" x 3" x 2"
- 1 Power transformer 225V 50 mA. 6.3V 2A.
- 1 Filter choke 12H. 60 mA.
- 1 8" speaker
- 1 speaker transformer 7000 ohms, suit speaker.
- 1 engraved panel.

VALVES

1 EF86, 1 6AU6, 1 6BV7, 1 6X4

RESISTORS

1 5 meg. ½w, 1 1 meg ½w, 5 .5meg. ½w, 4 .5 meg. potentiometers, 2 .25 meg. ½w, 2 .05 meg. ½w, 1 1000 ohm ½w, 1 2000 ohm ½w, 1 125 ohm ½ or 1w, 1 50 ohm CT 5w.

CAPACITORS

3 25 mfd 40PV midget electrolytics, 1 16 mfd 525PV electrolytic, 1 16 mfd 350PV electrolytic, 1 8 mfd 350 PV electrolytic, 2 .1 mfd 200V paper, 2 .05 mfd. 400V paper, 1 .01 mfd 350V paper.

- 2 9 pin miniature sockets.
- 1 7 pin miniature socket.
- 1 7 pin miniature socket with shield.
- 2 single circuit jacks.
- 1 microphone connector.
- 1 indicator bezel.
- 1 6.3V dial lamp.
- 1 dial lamp socket.
- 4 small finger grip knobs.
- 1 3 terminal tag strip.
- 1 8 terminal tag strip.
- Shielded hookup wire.
- Spaghetti sleeving to suit above.
- 3 core flex.
- 2 core flex for speaker.
- Grommets, tinned copper wire, solder lugs, nuts and bolts, hookup wire etc.

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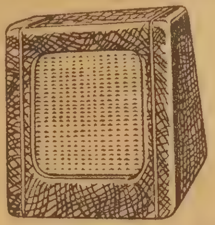

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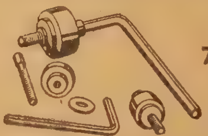

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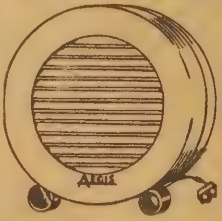

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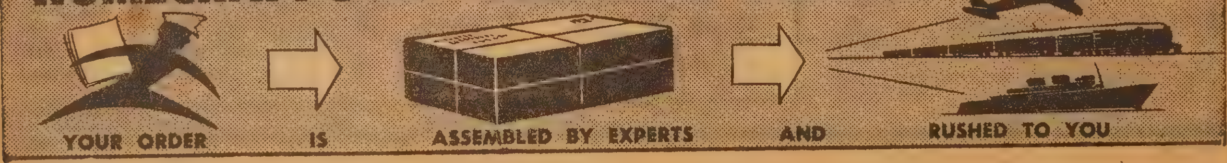

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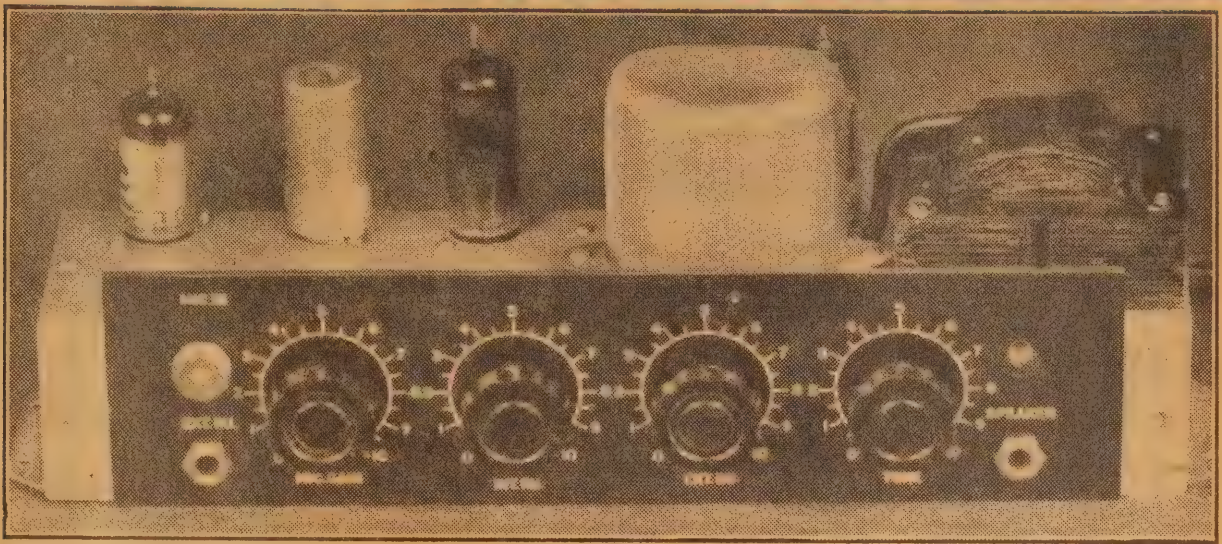

This view shows the layout of parts above the chassis. Left is the EF86, the 6AU6 in the shield can, and the 6BV7. The 6X4 is behind the output transformer. Note the horizontal mounting of the power transformer and the filament leads encased in plastic sleeving.

action between them.

For the pre-amplifier we used an EF86. This is a valve specially designed for work of this kind and features high gain, low hum level, low microphony and low noise level. It is thus the natural choice for this position.

A .5 meg. resistor from the plate of the 6BV7 to the plate of the 6AU6 provides negative feedback and a potentiometer and capacitor in the grid of the 6BV7 gives a simple but effective top-cut tone control system. This is useful for reducing scratch or providing some compensation for microgroove records. If it is not sufficiently effective for individual requirements the value of the capacitor may be increased, though it is not likely that more than double the value could be tolerated.

The gain of the amplifier is quite sufficient for use with the average crystal pickup, either on standard or microgroove records. The natural bass boost of these pickups makes them ideally suited for a simple system of this kind and no compensating circuits are necessary.

MICROPHONES

The microphone channel has ample gain for use with a crystal microphone and should also be quite suitable for the dynamic types. Ribbon types are somewhat lower in output and there may be some doubt about their ability to drive the system. Much will depend on the individual type, and it would seem wise to check the position carefully if one of these is contemplated.

On the front panel of the amplifier is a shielded microphone connector, one single circuit jack for the external pickup, and one for the speaker voice coil outlet. Connection to the internal pickup is made by means of terminals at the rear of the chassis.

The amplifier is built on a long, narrow chassis, this shape being dictated mainly by the cabinet. It was also desirable to minimise the height of the cabinet and we were able to reduce this a little by mounting the transformer horizontally rather than in the conventional upright position.

The chassis as supplied by the makers will have a suitable cut-out in it, and it is only necessary to remove the four bolts which hold the stack together, slip off the unwanted bracket, and sit the transformer over the chassis cut out. In our model all the leads except the filament leads came out one side of the transformer and we mounted this side down and with the leads to the rear of the chassis.

FILAMENT LEADS

The filament leads are encased in a length of plastic tubing and passed through a hole in the chassis near the transformer core. Alternatively they may be left uncased and a grommet fitted in the hole.

The speaker transformer is mounted toward the front of the chassis, with its longest dimension lengthwise, and the filter choke mounts under the chassis against the rear. A small choke is quite adequate, the one we used being rated at 60 mA, 12 henries.

The valves are along the rear of the chassis and this enables most of the components to be mounted reasonably clear of the front and the four control potentiometers. This is important, since it may be necessary to replace one of these some time and this should be possible without wrecking half the wiring.

No great difficulty should be experienced in keeping everything well clear of the two centre controls but things are a little more crowded around the "Mic. Gain" and "Tone" units. To make things easier, we have designed the chassis with slots rather than holes for these two positions. It will still be necessary to remove the front panel but this is not difficult and generally preferable to unsoldering a lot of minor components.

In spite of the small chassis, there is plenty of room for everything provided a little care is taken in the layout and choice of components. Half-watt resistors are used throughout with the exception of the filament centre tap resistors and the 6BV7 bias resistor. The latter could also be of half-watt rating but will probably not be available in smaller than one-watt.

SMALL COMPONENTS

Reasonably small capacitors should also be chosen, though the ones we used are now practically a standard size. The midget 25 mfd electrolytics are particularly important, since the older types would be much too large.

Orientation of the valve sockets is important if leads and components are to fall logically into place and the following is the arrangement in the original: EF86, gap toward nearest front corner of chassis; 6AU6, gap toward nearest rear corner of chassis; 6BV7, gap toward microphone control; 6X4, gap toward power transformer.

As with all compact construction it is important to work in the right order to enable the job to proceed smoothly. Otherwise it is all too easy to find that a socket pin you wish to work on has already been built out.

Assuming that all the major components are mounted, the wiring may be commenced. First the power transformer leads may be taken to their various terminal points. The secondary connections will be on and around the 6X4 socket, while the primary winding is terminated on a three-terminal tag strip near the end of the chassis. This must be mounted by means of a countersunk screw before the transformer is mounted.

To this runs a length of three-core flex from the mains and also

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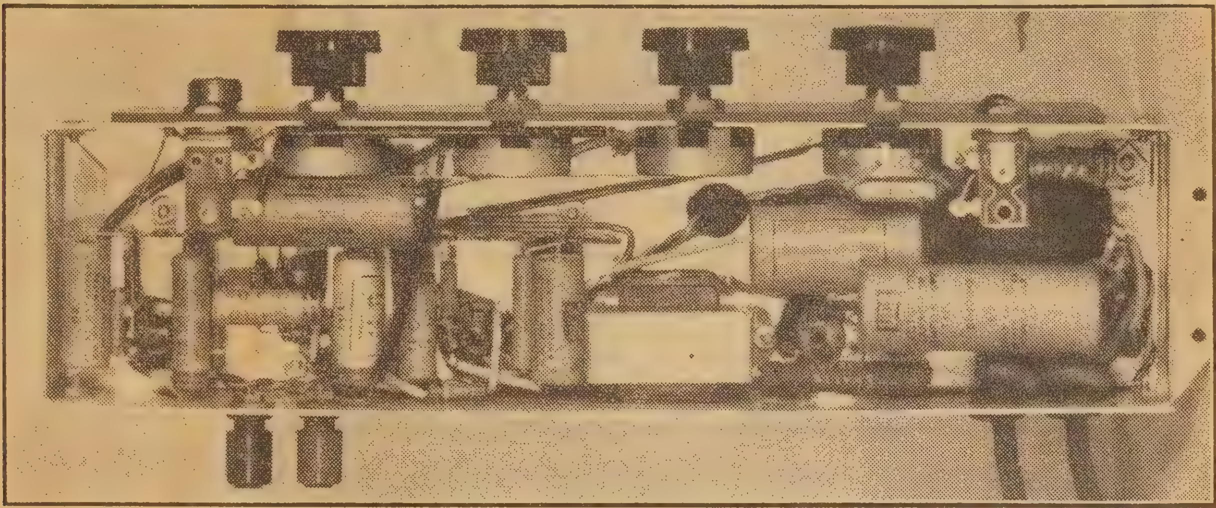
UNDER-CHASSIS SHOT SHOWS COMPONENT LAYOUT



An underchassis shot showing the placement of the major components. The EF86 socket is on the left, then the 6AU6 socket (partly obscured) and the 6BV7 socket. 6X4 is to the right of the filter choke. Note the single earth return system around the EF86 socket.

a second length which is to convey power to the turntable motor. Both enter the chassis through holes in the rear of the chassis, are protected by grommets, and are knotted to avoid strain on the terminals.

At this point, if using a steel chassis, it will be necessary to run an earth wire of tinned copper wire from socket to socket. A solder lug should be slipped under each socket bolt as it is fitted and these linked with the tinned copper wire. All earth connections should be made to this wire rather than to the chassis itself, since it is difficult to make a satisfactory and permanent connection to a steel chassis.

Except in the case of the 6X4 socket, the centre spigot of the valve sockets should be earthed. This is particularly important at the EF86 socket. It is also a good idea at this stage to earth any socket pins which are so indicated in the circuit.

CENTRE TAP

Twisted filament leads should now be run to each socket and the centre tap resistor mounted on the two filament pins of the 6X4. The centre tap should be left unconnected for the time being in case its best earthing point should prove to be critical. In our case, it was not so and we earthed it to a lug under the 6X4 socket. However, if hum in the microphone channel should prove a problem, an alternative earth may prove helpful.

We have provided a simple indicator light on the panel, using a low-cost plastic bezel which is fastened in place with a patent spring clip. This may be illuminated by means of a dial lamp mounted behind and held in a lamp socket fastened under one of the transformer mounting bolts. Be sure to use a lamp holder which has both sides insulated, so as not to interfere with the centre-tapped filament.

These parts should be mounted and wired at this stage, after which the speaker transformer primary leads may be connected to the 6BV7 socket and the secondary leads run to the panel jack. Now the two filter capacitors may be fitted, the choke wired, and the power supply end of the chassis will be complete.

Now we come to the amplifier section proper. Here we need to mount a number of small components around each socket and this is helped considerably by the use of two eight terminal tag strips running lengthwise, slightly forward of the centre line of the chassis. The general idea is that one end of each component is terminated on the socket pin and the other end on a tag strip terminal.

It will probably be most convenient to start with the 6BV7 socket and work forward toward the microphone amplifier. The cathode bias resistor and 25 mfd capacitor may be mounted first, being earthed on an appropriate terminal on the tag strip. Next the .05 meg. grid stopper, also to a tag terminal, and a lead is run from this point to the tone control potentiometer, which acts as the 6BV7 grid resistor.

The coupling capacitor from the plate of the 6AU6 lies across the chassis and should be fitted next, along with the plate and screen resistors. A lead is run from the filter choke to a tag strip terminal, which then serves as a HT point, and at which these resistors are terminated. Then the screen by-pass may be fitted, followed by the .5 meg. feedback resistor.

CATHODE CIRCUIT

Now fit the 6AU6 cathode resistor and by-pass, remembering that pins 2 and 7, being the cathode and suppressor respectively, must be bridged. This makes things a little easier since it is most convenient to connect the resistor to pin 2 and the capacitor to pin 7. The other end of each connects to an earth lug on the tag strip.

To the grid pin of the 6AU6 are connected three .5 meg. resistors, being the isolating resistors of the mixer system. These lie side by side and are terminated on three separate terminals. From these terminals leads will eventually run to each potentiometer, but these should be left for the time being.

The .05 meg. decoupling resistor connects from the HT point serving the 6AU6 to a new terminal which becomes the HT point for the EF86. This point will eventually be bypassed with the 8 mfd electrolytic, but this should also be left out for the present. Plate and screen resistors, screen bypass, and coupling capacitor are now mounted in that order.

Coming to the grid side of the EF86 we have to take a little more care. Because of the high gain involved, it is quite easy to pick up hum due to earth loops, and it is most important that all earth returns for the input circuit should be made to the same physical point.

By reason of its construction, it is not particularly easy to insulate the frame of the microphone socket, so it was decided to bring all returns to this point.

SHIELDED CABLE

Shielded cable must be used to connect the microphone socket to the valve grid pin and this also must be earthed only at the selected earth point. For this reason it should be encased in insulating sleeving so that it does not touch the chassis at any point except where it is deliberately connected to the microphone socket.

The 5 meg. grid resistor, the cathode resistor and the cathode bypass are all terminated on a terminal (NOT the earthed terminal), and a connection run to the microphone socket.

Now we may connect the three isolating resistors to the moving arms of their respective controls. The microphone gain control is so close to the terminals that only a short length of bare tinned copper wire is required, but the others involve longer runs and shielded lead should be used. Because the signal is at much higher level in

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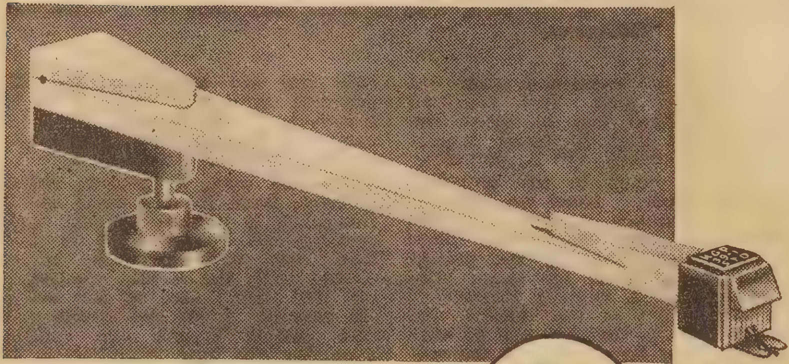

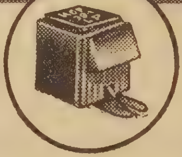

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Output 1 volt on standard and ¼ volt on long playing records. Tracking weight 10 grammes maximum. Response characteristic smooth with no resonance. Cartridge works into load resistance of ½ megohm and crystal capacity of 1000 picafarads ensures adequate bass response.

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these circuits the earthing is not particularly critical, but it is unwise to trust to a steel chassis for the earth return.

The "hot" end of the microphone control runs to the coupling capacitor from the plate of the EF86, via a tag strip terminal. The 8 mfd decoupling capacitor may now be fitted, followed by the "Ext. P.U" jack. Shielded lead runs from this jack to the "Ext. P.U." control.

Shielded wire also connects the "Int. P.U." control to the terminals on the rear of the chassis. Obviously the hot terminal must be insulated from the chassis. Any shielded lead which is in danger of shorting to other circuits must be encased in insulating sleeving.

With the wiring completed everything should be carefully checked, a speaker connected, the centre tapped resistor temporarily earthed, and the mains voltage applied. If all is well the two pickup inputs should show signs of life when touched with the finger and their respective controls advanced.

HIGHER GAIN

The microphone circuit should show similar characteristics, only much more so. With the gain fully advanced there should be a healthy valve hiss, but very little hum. In our case, with the input shielded by screwing on the unwired cable portion of the connector, the hum level was negligible. With a microphone connected it is difficult to advance the control very far, even with the microphone effectively sealed off from the speaker. Thus the full gain is not likely to be needed, but should be hum free if it is.

Details of the cabinet construction and dimensions are given elsewhere and you may either make your own or buy it ready built. In either case it is advisable to check the dimensions of your equipment first to be quite sure that it will fit in these dimensions.

Our cabinet was designed for an 8-inch speaker having a depth of 3¾ inches. Most speakers should fit in this space, and it might even be possible to use some of the 12-inch types, there being an actual clearance above the turntable of approximately four inches. However, watch the position which the magnet will occupy since this must be sufficiently offset to clear the centre spindle of the turntable.

MOTOR DIMENSIONS

The turntable used was the BSR type and this requires a depth of 4 3-16in from the top of the turntable to the inside bottom of the case, allowing about ¼in for movement on the spring mounting. Other units which can be accommodated in this depth may possibly be used though it will also be necessary to consider other dimensions, particularly if a 12in turntable is contemplated.

When the unit and projector are located at the back of a room or hall it will be necessary to exercise care in setting the gain of the microphone, otherwise violent feedback can occur. This is perfectly normal, and there is not a great deal which can be done to prevent it, other than to keep the gain within suitable limits and work close to the microphone.

The choice of a microphone with a smooth response will help, since a peak in the system will aggravate the tendency to feedback before maximum gain is achieved.

Where the screening is from a projection room this trouble will not be so serious, but it is then necessary to provide a means of monitoring the program, particularly the musical portion.

MONITOR SPEAKER

A second speaker may be connected to the voice coil circuit and a separate volume control fitted to it. This can take the form of a potentiometer of about 20 or 30 ohms operating in the voice coil circuit. Such an arrangement will not upset the matching seriously, and will enable the speaker to be set to a level where there is no danger of feedback, but where the musical portion can be heard sufficiently clearly to permit identification.

Another method is to use headphones, and these may also be connected across the voice coil. Although they have the advantage of avoiding a feedback they are not always the most convenient when one has to tend a projector and amplifier at the same time.

The engraved panel is really essential for a unit of this kind, quite apart from giving it a professional appearance. This is because it is essential to be able to make quick changes from one turntable to another or from microphone to a particular turntable without confusion. Without suitable identification of the controls, confusion can easily arise.

PROGRAM PREPARATION

The calibration markings for each control are also valuable since they enable a control to be pre-set to suit a particular record or to provide a particular effect.

Naturally all presentations should be carefully rehearsed and a detailed script built up around the commentary. This should show the records to be used, the exact time they are to be faded in and any data necessary to enable a particular portion to be selected.

For movie work exact timing is most essential and it is often difficult to anticipate a scene with sufficient accuracy for smooth changeovers. A very useful aid is some form of counter which is fitted to the projector and which will measure accurately the passage of film through it.

With such a device, it is comparatively simple to run the film slowly through the projector, and note the counter number for each change of scene or mood, or incident which calls for special comment. These numbers are entered on the script along with appropriate comments and data regarding music, dialogue, &c., ad it is then comparatively easy to anticipate each change by simply noting the numbers on the counter as the film is projected.

There are many types of counters available commercially which would be suitable for the job and they are not expensive when one considers the value of the equipment already involved. A very desirable feature is that they should be reversible so that the film may be run backward to find a particular spot without upsetting the count on the meter.

ELECTRONIC PARACHUTE

(Continued from Page 23)

identical to the original bridge unbalance signals. This signal is applied to a cathode-ray oscilloscope and photographed on moving 16-millimetre film film. The output of the ground station is thus a continuous film record of the eight original signals.

To make this record useful, it must be converted to individual curves showing altitude and the various harness tensions against a common time scale. This otherwise time-consuming conversion is expedited by a specially designed film reader.

Using this device the operator adjusts potentiometer-connected mechanical tips to coincide with the signal peaks of the projected film image. When the tips have been so adjusted for one scan of eight channels, the seven information channels are automatically recorded on a strip chart. The recorder chart is advanced automatically, and the entire procedure is then repeated until all information of interest has been transcribed.

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Here's your answer, Tom!

Tom's first question this month is an evergreen puzzle for those who are just beginning to find their way around a circuit. We have answered it before and we'll probably have to answer it again before these columns have passed into the limbo of forgotten things.

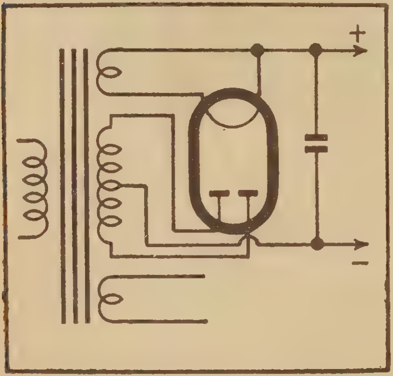
TOM has apparently noticed the practice of earthing heater circuits and can't quite reconcile it with his conception of how a rectifier works. We reprint his question exactly as it appears in his letter:

> **In 240-volt circuits, the high tension wires go to the cathode or the earthed side of the rectifier valve . . . or is it earthed some other way? It has me puzzled how the circuit could get a high tension supply this way.**

We wouldn't give you top marks in English for the way the question is framed but your difficulty is clear enough—and that is the most important thing.

Let's start at the beginning.

The voltage supplied by the power mains is alternating and therefore unsuitable for direct application to the plates of the amplifier valves.



Full-wave rectifier

Before being so applied, it has to be rectified (turned into DC) and this is the job of the rectifier valve.

This much you probably understand, Tom, but the confusion arises from your reference to the "cathode or earthed side" of the rectifier valve. Actually, these two terms should not be coupled together like that, because the cathode doesn't necessarily have to return to earth.

MERELY CONVENTIONAL

The most that one can say is that it is conventional to earth the cathode circuit of amplifier valves and likewise the negative side of the high tension supply. The positive side of the supply—or B-plus—is therefore above earth, as also are the plate circuits.

However, while this happens to be a convenient and conventional arrangement, it isn't the only one possible.

Some amplifier circuits, like those in an oscillograph, may be arranged with B-plus and the plate circuits connected to earth. The cathodes may be several hundred volts negative!

As far as the valve is concerned, the important thing is to have the plate positive with respect to the cathode, the "earth" return being more or less incidental.

DIFFERENT PROPOSITION

Actually, the function of a rectifier in a circuit is quite different from that of an amplifier valve and it only makes things difficult to try to compare them, Tom.

The one important job in a rectifier's life is to pass current only in one direction. Let's see how this works out:

An alternating voltage is applied to the two plates in the rectifier by a centre-tapped high-tension winding on the power transformer. The centre-tap is usually earthed in some way or other so that the net effect is to make the two plates alternatively positive and negative.

One swings positive while the other swings negative and so on, alternatively, vice-versa and ad lib! (We wouldn't get many marks for that sentence either, Tom, but we hope you're still with us.)

When either plate swings positive, it attracts electrons from the rectifier cathode, so that a current flows through the tube.

In losing electrons (or negative charges) by emission, the cathode automatically acquires a positive charge.

To say it again, another way: If the cathode loses negative charges (electrons), it must become less negative as a result—which is the same thing as saying that it becomes more positive.

YOUR OWN CASE . . .

Just in case this still isn't clear, we can use your own bank balance as an illustration, Tom.

Your financial position is determined by your assets and income on the one hand, and by your liabilities on the other. If you could persuade a kindly neighbor to pay all your bills as they came along, you would automatically become more wealthy because you would have lost your liabilities.

And that's just about the way it is with a cathode; by continually giving up negative charges, it automatically tends to go positive.

In the case of a full-wave rectifier, the process is more or less continuous. Each time one plate or the other swings positive, the cathode emits a stream of electrons and tends to go positive also. It never gets the chance to go negative, because electrons simply won't flow backward from plate to cathode!

So we have our cathode going positive in bursts, which is another way of saying that the output from the cathode is pulsating DC. If applied to the rest of the receiver in this form, however, it would produce an intolerable amount of hum in the speaker.

To minimise this effect, it is usual to wire a large electrolytic capacitor between the cathode and the negative side of the high tension supply. This exerts a kind of storage effect which holds the cathode to a more or less steady average potential.

If the output is still not smooth enough, then it is fed through a filter choke to another large filter capacitor before being applied to the rest of the set.

NO EARTH CONNECTION

Out of all this, Tom, it becomes perfectly clear that the rectifier cathode cannot have any connection to earth, otherwise it would short the high tension output. It also highlights the error in your phrase, "the cathode or earthed side" of a valve.

We could perhaps frame the next question ourselves:

ALL BILLS NEXT DOOR

A kindly neighbor

What is the difference then, between a filament type valve like the 5Y3 and an indirectly heated type like the 6X5?

To answer this question, Tom, it is necessary first to define what we mean by the term "cathode", as used throughout the earlier paragraphs.

Very simply, the cathode is that portion of the valve from which the electrons are emitted.

In a 5Y3, the electrons are emitted directly from the surface of the filament. It is, therefore, a "directly heated" type and, in operation, the filament must be free to go positive.

For this to be possible, the filament winding must be operated from a separate winding on the power transformer, which has no direct connection to earth. In fact, the insulation on the transformer must be good enough to withstand the high voltage on the winding.

INSULATED CATHODE

More recently, there has been a move to use indirectly heated rectifiers, in which the cathode sleeve is insulated from the heater element. This makes it possible to operate the heater element from the same earthed winding as other valves in the set.

The high tension output is taken from the cathode pin, so that the cathode sleeve is positive with respect to heater by the full HT voltage. The insulation between them is made to stand this, however.

As distinct from types like the 5Y3 and 6X5, there are a few rectifiers like the 5V4, which have indirectly heated cathodes but with cathode sleeves connected internally to one side of the heater.

The valves were made this way in the first place to achieve low internal resistance. However, since the cathode is not separately accessible, being tied to the heater internally, the valve must be operated from a separate heater winding, just like the 5Y3.

Why are valve heater circuits earthed, anyway?

As you will have appreciated by now, Tom, valve heater circuits aren't always earthed as a matter of course. Some are, others are not.

ONLY FUNCTION

Fundamentally, it shouldn't matter to the valves whether their heaters are earthed or just left floating because, except for a very few directly heated types, the heater is simply there to make the cathode hot. It does not in any other way enter into the fundamental operation of the valve.

However, one or two secondary effects can take place, which are sometimes important.

For example, if heater wires strung between successive valve sockets are not tied down, anything can introduce stray coupling between circuits and lead to feedback troubles and oscillation.

Then again, being fed from the power transformer, the heater wiring can be regarded as being coupled to the high voltage windings by the capacitances inside the transformer. Unless the heater wiring is tied down in some way, it can conceivably couple hum signals from the power transformer to some of the grids, causing hum to appear in the output.

We could probably dig out and list other minor effects, but to no special purpose. The point of the matter is, Tom, that earthing the heater circuits is generally a very simple procedure and warranted in most receiver and amplifier stages.

In some cases it is sufficient merely to connect a wire from one side of the heater circuit to chassis. In other cases, notably in high gain audio amplifiers, a more specialised approach is sometimes necessary to cut out hum arising from the proximity of heater wires to active leads, even inside the valves themselves.

To achieve this and also prevent very slight emission effects between the heater surface and other electrodes, the heater is sometimes earthed via a centre-tapped resistor or a centre tap on the heater winding.

Occasionally, as in some of our Playmaster amplifiers, best results are achieved with the heater circuit returned, not direct to earth, but to a point somewhat positive with respect to earth.

We suggest, for the time being, that you be guided by the circuit in this respect.

But remember, Tom, don't go earthing that rectifier cathode!

How can you keep a screen at earth potential by bypassing it to earth with a condenser?

To be consistent, Tom, we should have re-worded your question to use the term "capacitor" instead of "condenser". Both words mean the same thing, but "capacitor" is the modern term, which we are favoring as a matter of policy.

BACK TO THE PROBLEM

However, you didn't ask for a lecture on terminology, so we'll say no more on the matter.

Actually, a bypass capacitor does not hold a screen at earth potential in the strict sense of the term, since the screen is above earth by the applied DC potential — whatever it happens to be.

The reference that you are apparently quoting would apply to the screen potential in relation to signal frequencies.

In an RF pentode the main function of the screen is to minimise capacitive coupling between plate and grid. This capacitive coupling tends to feed amplified signals in the plate circuit back to the grid and thus cause instability.

When a screen grid is inserted between the two electrodes, as in a tetrode or pentode, the direct plate-grid capacitance is greatly reduced, although there still exists capacitance between plate-screen and screen-grid.

Very obviously, the screen would serve no useful purpose if signals in the plate circuit were capacitively coupled to the screen and thence to the grid.

The screen can only be a screen, in the proper sense of the term, if it can be kept entirely neutral — in other words incapable of transferring signals from plate to grid by capacitive effects.

The best way to ensure against this would be to connect the screen to cathode, but, unfortunately, a relatively fine pitch grid in the position the screen has to occupy would just about prevent altogether the flow of electrons through the tube.

For this reason, it must operate at an intermediate positive voltage, sufficient to assist rather than prevent the movement of electrons from cathode to plate.

The problem therefore is to have a positive voltage on the screen and yet have it tied down in such a way

(Continued on Page 112)

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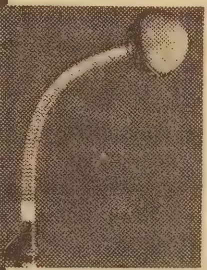
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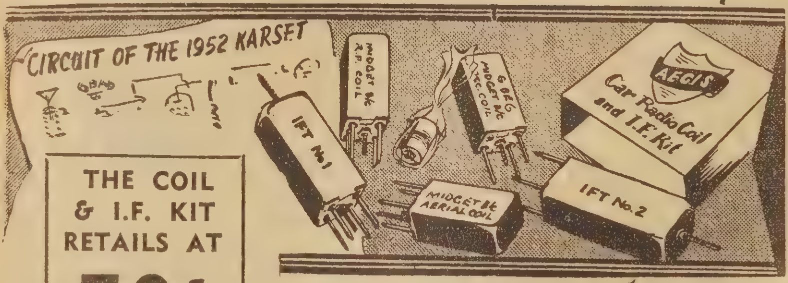
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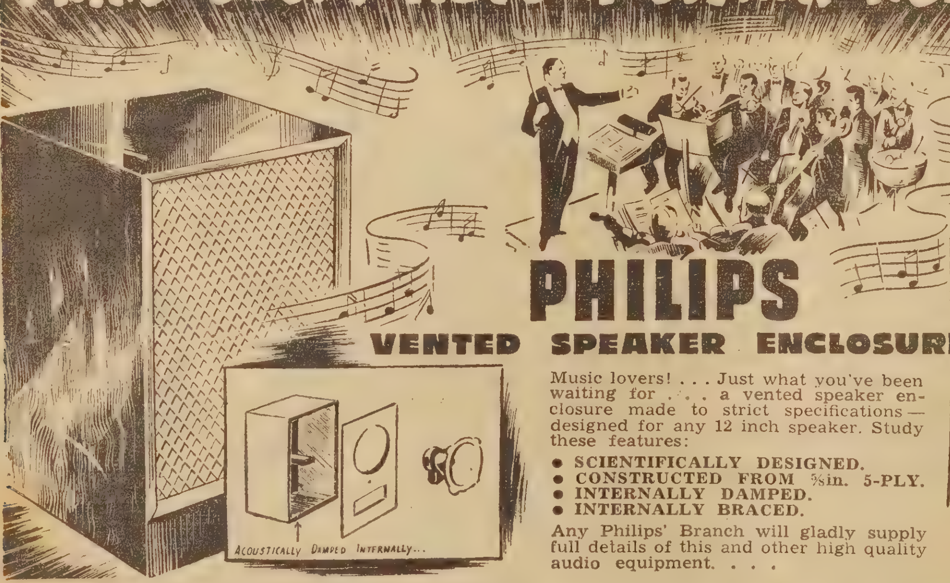
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A CABINET FOR THE "GP JUNIOR"

You can save a good deal on cost by constructing your own case for the new "GP Junior" amplifier, featured elsewhere in this issue. By following these instructions and the plans on the next page, you should have no difficulty in making up a very attractive and serviceable unit.

As you will already have noted from the previous article, the case consists of two separate units. One sits flat on the table during use and carries the turntable and amplifier. The other section, carrying the speaker, can be placed in the most advantageous position.

For carrying, the two units are clipped together and resemble an ordinary rectangular suitcase.

To accommodate the various components, we selected inside dimensions of 16in x 13in x 8in. Allowing for the 3-8in ply, which is used in the construction, this gives outside dimensions of 16¾in x 13¾in x 8¾in.

USE PLASTIC BONDED

We found the 3-8in ply to be very convenient for the purpose and suggest that you select the grade known as "plastic bonded" or "waterproof". This has much less tendency to splinter when sawn and is thus much easier to work.

At first thought, the simplest way of making such a case would be to construct a complete rectangular box and then proceed to saw diagonally through it.

However, unless you are an experienced wood craftsman, we do not advise this method. A "band saw" would be just the thing for this operation, but, since very few of us will be in the position to use one, it will be necessary to make up the case as two separate units.

The lid measures 3 1-8in deep at one end and slopes to 5¾in deep at the other. These are outside dimensions, so that the actual depth of the end pieces will be less the 3-8in thickness of the top of the lid.

Assuming a similar speaker and turntable to that used in the original, the case will slope from 3in at the shallow end to 5 5-8in at the deep end. These ends will also be cut shorter than these dimensions by the 3-8in thickness of the bottom.

ALLOW FOR SLOPE

In cutting these end pieces, an 1-8in or more must be allowed for sloping the edges to follow the lengthwise diagonal cut of the case. It is better to leave this operation until after the tacking and glueing are completed, then shape the ends with a sharp plane.

The end pieces are butted to the sides and so are cut to the inside dimension of 13in. To ensure that the ends for both case and lid are the same size, the four pieces should be clamped together and the ends planed in one operation.

The side pieces overlap the ends and so must be cut to the outside dimension of 16¾in. As with the end pieces, the four side pieces, two for the case and two for the lid, should be clamped together and their ends dressed in one operation.

The top of the lid and the bottom of the case should be cut slightly larger than the nominal dimensions and not dressed to size until after the sections are assembled. This will enable you to dress the edges in line with the sides and is a safeguard against small discrepancies in measurements.

SPEAKER FRET

Before finally assembling the lid, cut out the speaker fret, as it will prove an awkward job with the sides in position. The centre point of the speaker fret is midway between the sides and 10 1-8in from the outside rear edge.

Mark out the desired design as indicated in the diagram. Drill a few holes in each segment of the cutout to enable a fret or coping saw to be inserted and carefully cut along the inside of the marked lines. Finish off and "round" the edges with a file and sandpaper.

The control panel cutout is best left until after tacking and glueing. The glue will then support the 1-8in "lip" on the lower edge of the cut-out and prevent the strip from splitting.

When fitting the bottom of the case, apply a liberal application of glue along the edge of this strip and use panel pins only on either side of the control cutout.

WOOD FINISHING

When both halves have been assembled and the cutouts filed smooth, all protruding edges and corners may be "rounded" with a suitable wood rasp file or a course grade of sandpaper.

Also, at this stage, the panel pins should be punched just below the surface of the wood and the resulting holes plugged with putty or plastic wood. At the same time, all splits or cracks that have occurred while preparing the wood may be treated in the same manner.

The motor board is approximately 13in x 12¾in and fits snugly into the case, held in position by wood screws, and resting on "cleats" around the inside. Timber used for the board is again 3-8in ply.

MOTOR CUTOUT

The cutout in the motor board should be marked out with the aid of the "template", usually supplied with the motor. However, if no template is available, it is wise to try a suitable cutout on cardboard first, and then transfer it to the board.

Position the motor and pickup assembly centrally between the two sides and locate the centre spindle of the turntable 6¼in from the inside rear of the case.

Before proceeding farther it should be pointed out that the dimensions relating to the height of the motor board are based on the dimensions of the speaker and turntable used. Where these differ from the original it may be necessary to modify the design slightly.

The depth of the speaker from cone face to the rear of the magnet is approximately 3¾in and the overall depth of the motor is 4in. From the turntable to the top of the motor board is 1¾in and from the top of the motor board to the bottom of the motor, 2¼in. Approximately ¼in is left under the motor to allow movement on the mounting springs.

The cleats can be cut from scraps of 3-8in ply. Dimensions are not critical but a width of ½in and a length of 9in should be suitable for all three pieces. When positioning the two side cleats, make sure there is sufficient room to withdraw the amplifier after the motor board is removed.

AMPLIFIER COVER

A protective cover for the amplifier is fitted to the top front of the case. It is made from 3-16in ply and supported by cleats on the inside front and two sides of the case. It measures 13in x 3½in and sits flush with the front and sides of the case. Thus the side cleats will be 3-16in lower than, and parallel to, the sloping sides. The front cleat will also be lower by 3-16in and, in addition, must be planned at an angle to match the angle of the sides.

Both the motor board and cover are fastened with wood screws, since the former will have to be removed to service the motor and both will have to be removed to remove the amplifier.

The final finish is largely a matter of personal taste. Leatherette has many attractions and we have described in previous articles how this should be handled. For a change, we decided to finish with one of the glossy paints and the result is most pleasing. Not the least attractive feature of this method is the large range of colors from which to choose.

PAINTING

If you decide to paint the case, first make sure that no holes or cracks are left unplugged. Next, all surfaces must be sandpapered, a coarse grade being necessary to remove scratches and milling marks and a fine grade to give the final finish.

Care taken here in filling holes and sandpapering will be amply repaid in the quality of the finished job.

Next comes an application of flat undercoat. The color is not critical and white is suitable for most work.

(Continued on Page 113)

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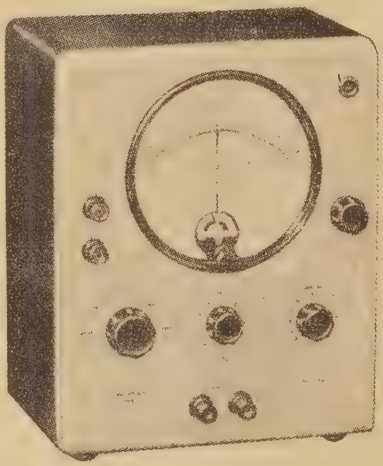

INSTRUMENTS FOR COMPONENT TESTING

DEVIATION TEST BRIDGE
Type 1502 and 1507

has been designed for use primarily in the production inspection of resistors, capacitors, and inductors. Operationally, the percentage of deviation of the component to be tested from a standard component is read on a large illuminated scale. The scale itself has two ranges. The indicating meter is of the moving coil type and is equipped with a specially constructed pointer to aid in reading. The Deviation Test Bridges have a very high indicating speed, making it possible to test as many as 4,000 resistors or 2,000 transformers per hour. The range calibration and the zero adjustment are readily performed by means of a built-in standard. The stability of these units is very high and readjustment of the standard controls is generally necessary only once a day.

SPECIFICATIONS

MEASURING OBJECTS FOR DEVIATION MEASUREMENTS	TYPE 1502	TYPE 1507
Resistance	10 Ω-10 MΩ	20 Ω-100 kΩ
Capacitance	50 pF-10 μF	25 pF-0.1 μF
Inductance	2 mH-100 H	100 μH-0.3H
MEASURING OBJECTS FOR DIRECT READING WITH EXTERNAL STANDARDS		
Resistance range from ..	0-0.7 Ω to 0-3.3 MΩ	
Capacitance ranges from .	0-7 pF to 0-3.3 μF	0-7 pF to 33 μF
Measurement Frequency .	1000 c/s	50 kc/s

INSTRUMENT: Large moving-coil instrument and illuminated scale with zero point in the centre. The instrument is safeguarded against overloads. Full scale deflection from — 7% to + 8% on one range, and — 25% to + 35% on the other range.

COMPARISON ACCURACY: Better than 0.1% at zero point.

TOLERANCE ACCURACY: Better than 5% at full scale deflection.

SPEED OF OPERATION: Normal production test is 4,000 resistors or capacitors per hour.

STABILITY: The zero point is independent of the line voltage.

AC-HUM: The bridge is not sensitive to hum voltages.

TUBES: 3x6AU6, 6AQ5, 6X4, OA2, and in Type 1507 also 6AL5.

POWER SUPPLY: 115, 127, 150, 220 volts a.c. 40-120 c/s. 40 watts.

DIMENSIONS: 33 (height) x 28 (width) x 20 (depth excl. dials) centimeters.

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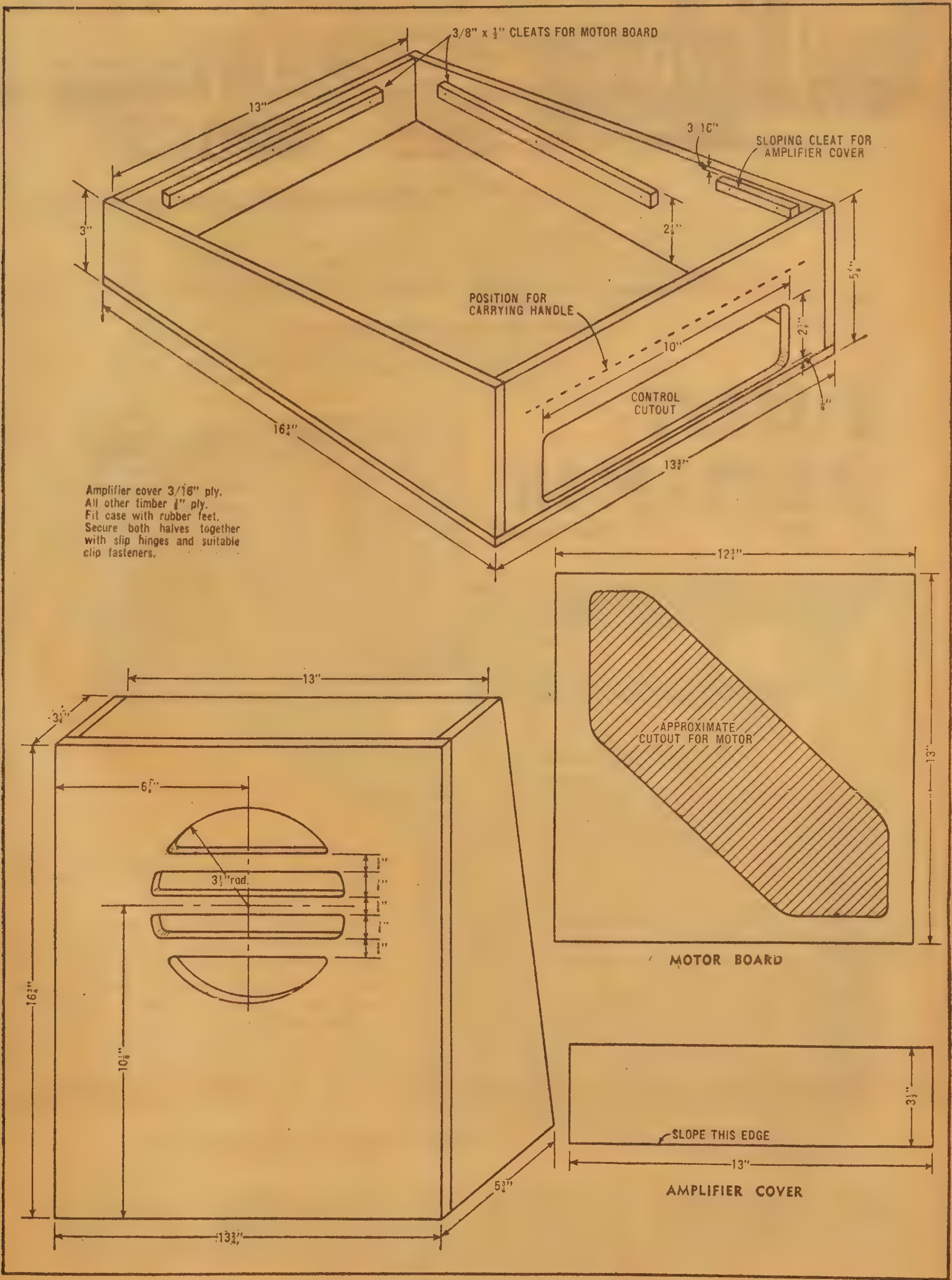
DETAILED PLANS FOR THE "G-P JUNIOR" CASE


3/8" x ½" CLEATS FOR MOTOR BOARD
13"
3 16"
SLOPING CLEAT FOR AMPLIFIER COVER
3"
2¼"
5⅝"
POSITION FOR CARRYING HANDLE
2¼"
10"
CONTROL CUTOUT
⅛"
16¾"
13¾"
12¾"
APPROXIMATE CUTOUT FOR MOTOR
13"
MOTOR BOARD
13"
3⅛"
6⅞"
3½"rad.
⅝"
⅞"
⅝"
⅞"
⅝"
16¾"
10⅛"
5¾"
13¾"
3½"
SLOPE THIS EDGE
13"
AMPLIFIER COVER

Amplifier cover 3/16" ply.
All other timber ⅜" ply.
Fit case with rubber feet.
Secure both halves together with slip hinges and suitable clip fasteners.

Sufficient details are given here to enable homebuilders to construct their own case. The front edge of the amplifier cover and the top surface of the supporting front cleat should be dressed to fit in with the diagonal cut of the case. In finishing "round off" all protruding corners and edges. The case can either be lacquered or covered in leatherette, according to your taste.

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TYPE PA 828

20 WATT AMPLIFIER

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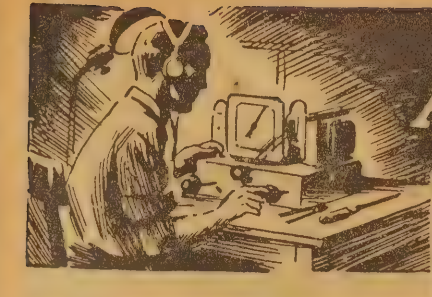
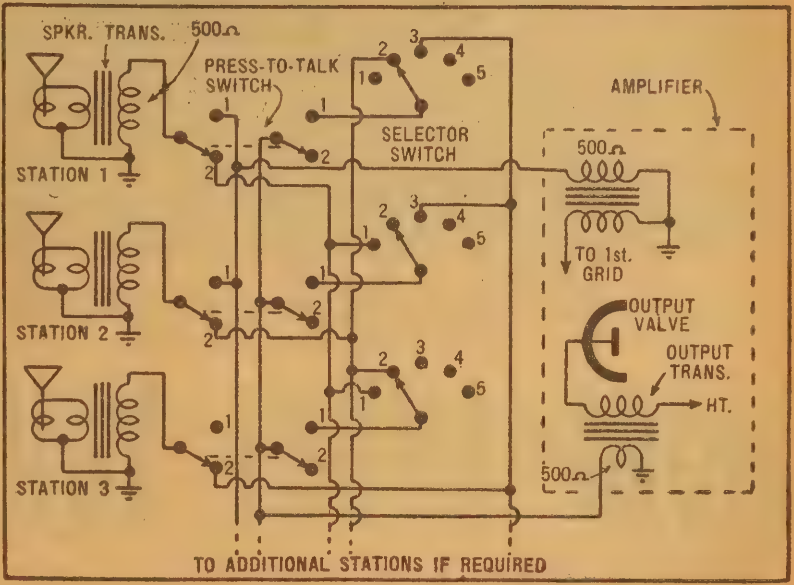


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

MULTI-STATION INTERCOM. USES COMMON AMPLIFIER

This multi-point intercommunication system may produce a couple of ideas on line switching for some of our readers. The system uses a common amplifier and can provide as many points as there are positions on the selector switch.



OUR corerspondent is Mr. K. R. Heathwood, of 14 Madeira Road, Mudgee, NSW.

The use of a common amplifier does economise on the outlay for the whole system, but it means that only one conversation can be carried on at the one time.

Each point or station carries a small speaker, say a 5-inch, in a wooden box, together with a speaker transformer, a station selector switch and a press-to-talk switch. Mr. Heathwood used a box measuring six inches square by three inches deep.

The speaker transformer is a line transformer having an impedance ratio of 500 ohms to speaker voice coil impedance. The selector switch will need one pole and as many positions as you desire intercom. stations. In the circumstances, a one pole, 11 position switch costs no more than other single bank switches and may as well be used from the outset, as it allows for expansion of the system at a later date.

PRESS-TO-TALK CIRCUIT

The press-to-talk switch requires an action which closes one circuit in the "listen" position and opens this circuit and closes two other separate circuits in the "talk" position. A disposals telephone switch would do the job nicely.

It should be appreciated that connections to the input and output of the amplifier are made to sections of this switch and unsuitable wiring to the switch, or the use of an amplifier with excess gain, may lead to some instability. In most cases, this can be overcome by reversing the connections to either the primary winding of the amplifier input transformer or the secondary winding of the output transformer.

As you will note, both the input and output of the amplifier operate at 500 ohms. This is a good choice because the effect of the DC resistance of the interconnecting lines is rendered negligible.

On the other hand, if the length of run between stations is fairly short, you could omit the transformer at each speaker, wiring one side of the speaker voice coil to earth and the other side to moving arm of the "press-to-talk" switch now connected to the secondary winding of the speaker transformer.

The input transformer at the amplifier could be a standard speaker transformer having as high an impedance ratio as possible between primary and secondary windings. The transformer at the output of the amplifier could again be a standard speaker transformer matching voice coil impedance to the optimum load requirements of the amplifier output valves.

It is to be emphasised that the voice coil arrangement is suitable for short inter-station runs only, where the DC resistance of the leads would not be greater than nominal voice coil impedance.

For a given length of run, the cross-sectional area of the leads used will govern their DC resistance. Two-core plastic-covered lighting flex could be used. It would be easy to instal and its DC resistance would be fairly low.

The connections to the amplifier should not be longer than necessary. It would be a good idea to connect it into the system somewhere near the centre so that stations at the ends of the system would be suffering much the same line loss.

In our contributor's case, it was possible to use bell wire for all wiring except the 500 ohm input grid wiring, which was in shielded hookup. A common earth wire will be necessary between all stations and the amplifier. The common impedance does not matter here as only one conversation can be carried on at the one time and the question of "break-through" does not apply.

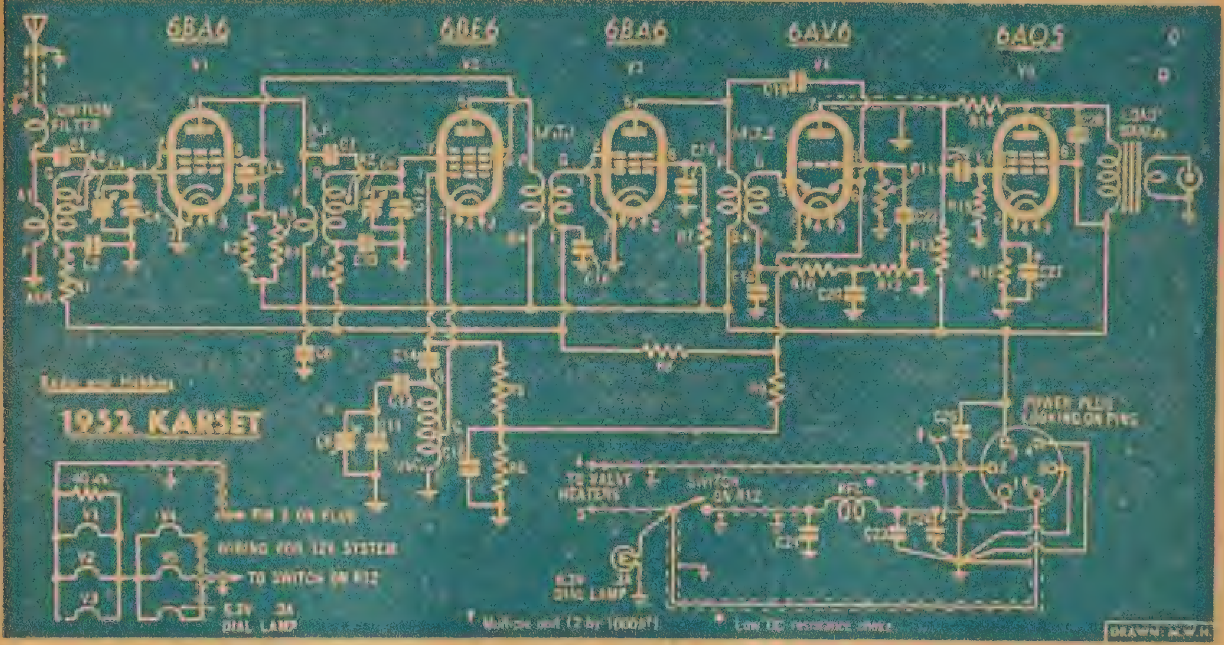
When fitting the grid input transformer on to the chasis of the amplifier, it may be necessary to orientate it for minimum hum pick-up from the power transformer. The amplifier used by Mr. Heathwood was a 4 watt AC-operated job of conventional circuit design.

SWITCH WIRING

In the wiring of the switches, you will see that with the selector switch, it is simply a matter of wiring together all No. 1 positions except the switch at station 1, all No. 2 positions except station 2, all No. 3 positions except station 3, and so on. The pole of each selector switch is connected to its associated press-to-talk switch.

Position 2 of the press-to-talk switch at each station is the "rest" or "standby" position, and is the position in which the switch is normally left, preferably returning to it by its own spring action.

Position 1 of this switch is the "call" or "talk" position. It connects the speaker, as a microphone, to the input of the amplifier and connects the output of the amplifier to the selector switch where it can be passed to the desired station.



Here is the circuit of our standard 5-valve "Karset", as described in the March 1952 issue. It is still current, in terms of design, components and metalwork being readily available. Views of the receiver, taken from the original printing blocks are available through the query service, but the issue itself is out of print. The power supply circuit is shown on the facing page.

MORE ABOUT YOUR KARSET

The Radio and Hobbies "Karsets" have proved to be one of the most popular series we have ever described. Despite the fact that literally thousands of them have been built, we are constantly receiving fresh enquires for the circuits and information pertaining to them. We present this article, therefore, with the idea of answering such enquiries "en masse".

WHEN faced with frequent requests, some years ago, to describe a car receiver for home construction, we weren't too happy about the proposition.

We weren't convinced, at the time, that the average reader could cope with the complexities of a miniature superhet, the problems of vibration in service, the hazards of a vibrator power supply, and finally, the job of installation in a car.

We well realised that only ill-will would follow if readers were induced to spend a lot of money on parts in the vain hope of being able to build an effective receiver.

CAREFUL PLANNING

A great deal of planning and forethought, therefore, went into the design of the original Radio and Hobbies "Karset". When the description finally appeared in May, 1949, there was quite a rush for kits and we were soon reading enthusiastic reports about its performance.

If vibrator hash and ignition interference were a trouble at all, they seldom seemed to prejudice reception of any but weak stations.

Because of the three-unit structure of the set—tuner, power supply and speaker—no great problems were encountered either with installation.

Readers proved to be quite equal to the task of making brackets and drilling the holes necessary to hold the units in position.

The unqualified success of the original "Karset" led to the description of the 1952 version, in March of that year. It differed from the earlier one in only minor details and in the use of a miniature 6AQ5 output valve.

This is now regarded as our standard design, where extremely high sensitivity is required for touring. Provided the car is of modern design, or suitably suppressed for ignition interference, there should be very few places where some kind of signal is not available on this set.

On a recent roadside test at dusk, and using a standard 6ft whip antenna, we counted eighty-two identifiable signals around the dial!

The circuit and parts list of the "1952 Karset" are reprinted herewith for those who may wish to study it. Unfortunately, copies of the original issue are no longer available, although views of the set, taken from the original printing blocks, are available through the two-shilling query service.

We have also reprinted circuit details of the "Four-Valve Karset", taken from the April, 1953, issue.

In this set, receiver and power supply are combined in one compact case, having the same frontal dimensions as the 1952 Karset, and only 8½in long.

PERFORMS WELL

Due to the use of a special aerial coil and high gain valves, the set turns in a very good performance, and is completely adequate for most purposes.

The original set has been in constant use for the past eighteen months and has never failed to give a good account of itself during ordinary daily and weekend motoring. The audio quality and power output are, of course, identical with the larger set.

It is simpler to build than the 5-valve version and somewhat cheaper, due to the elimination of a valve, a coil, one gang section and a good deal of metal work.

If you decide to build it, however, make sure to get the right vibrator transformer, which is physically smaller than the one used in the 5-valve set.

For those who may want to build either one of these receivers, we would stress the point that they must be built carefully, to withstand continuous movement and vibration.

Use lock washers under all nuts and see that all the major components are firm. See that the lids and cases fit together properly and instal packing where necessary to prevent rattles.

The wiring, too, must be neat and firm. Use miniature components wherever possible, because they simplify layout and are less likely to break loose from their pigtails.

Some readers have asked about ventilation, sensing that several valves must develop a good deal of heat in the confined space.

HEAT RADIATION

Actually the set is intended to radiate most of this heat from the metal case itself and no trouble should be experienced in the normal way. However, a pattern of small holes may be drilled, if you like, in the sides of the case, to afford some extra ventilation.

We would stress, however, that internal heating will be greatly accentuated by mounting the set in a glove box as some readers have apparently done.

Yet another frequent query has to do with the high tension voltage at which the sets are intended to operate.

In the original 1949 Karset, we deliberately kept the voltage on the plates, down to about 200, in an effort to reduce plate current, conserve battery drain and also avoid the need for too large a vibrator transformer.

Improvements in transformer design since then have made it possible to plan for a somewhat higher output voltage, with a consequent improvement in power output, &c.

Using current transformer types, the Karsets should now operate with a nominal high tension voltage of 250.

The figure is liable to vary, however, and readings between 225 and 260 should not be regarded as unusual.

The actual voltage will vary quite markedly according to the condition of the battery, the resistance of leads, switch contacts and chokes in the primary circuit, the condition of the vibrator and, of course, the DC resistance of the high tension filter choke.

PRIMARY CIRCUIT

It takes less than an ohm in a 6-volt primary circuit to drop the transformer input voltage (i.e. vibrator reed to centre-tap) to 5.5 volts. By simple calculation, the loss of this half-volt at the primary means a loss of 20 volts in the high tension output.

We discussed this matter at some length with transformer manufacturers and decided against making some arbitrary allowance for such ohmic losses in the primary circuit. They are not always present and they are offset, furthermore, by a rise in battery voltage when the car is in motion.

CIRCUIT CODE AND PARTS LIST

1 chassis 6in x 5¾in x 1in and box 6½in x 3½in x 7in (for receiver).

1 base plate 3¼in x 5¾in and box 6in x 3½in x 5in (for power supply).

1 car radio coil kit comprising AER and RF coils with tapped secondaries, Osc. coil to suit 6BE6 valve, two 455Kc IF transformers and ignition suppressor coil.

1 miniature dial (MSL/48 B/C) to suit gang.

1 miniature 3-gang tuning capacitor (C4, C11, C12).

3 small trimmer capacitors (C3, C8, C9).

1 6 or 12 volt vibrator transformer with 250v 60mA secondary.

1 Synchronous vibrator cartridge 6 or 12 volt to suit transformer.

1 15 henry 60mA HT filter choke.

5 Miniature valve sockets, with shield can.

1 6-pin valve socket for vibrator.

1 6-pin valve socket with cover.

1 6-pin plug (Chassis mounting type).

1 RF choke (may be in coil kit).

1 7in or 8in speaker with 5000 ohm speaker transformer.

2 Chassis-mounting single contact plug and socket assemblies (car radio type).

VALVES

2 6BA6, 1 6BE6, 1 6AV6, 1 6AQ5.

CAPACITORS

C1 100 pf.
C2 .05 mfd.
C3 trimmer.
C4 gang section.
C5, C6 .1 mfd.
C7 100 pf.
C8, C9 trimmers.
C10, .05 mfd.
C11, C12 gang sections.
C13 425 pf 5% mica.
C14 100pf.
C15, C17, .1 mfd.
C16, .05 mfd.
C18, C19, C20, 100 pf.
C21, C23, .1 mfd.
C22, .01 mfd tub.
C24, C25, 2 by 1000 pf. (UCC multiple unit)
C26 .01 mfd tub.
C27 25 mfd 40PV miniature electro.
C28 .005 mfd tub.
C29 .1 mfd.
C30 1000 pf UCC miniature.
C31, C32, .01 mfd 600WV tub.
C33, C34, 8 mfd 525 PV electrolytics.
C35 .5 mfd 200 or 400 WV tub.
C36, C37 2 by 100 pf (UCC multiple)
C38 .1 mfd.

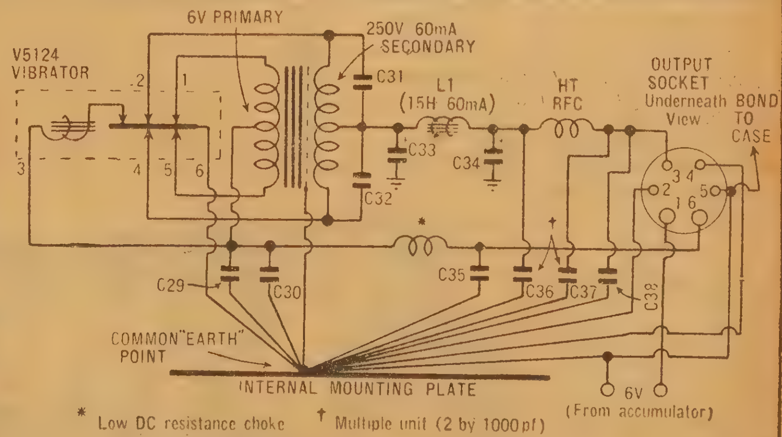
The 100 pf are UCC miniature (or similar). The .1 mfd and .05 mfd can be TCC 350v tub or 200v Aust. The .01 mfd are TCC 500v tub.

RESISTORS

R1, R4 .1 meg. ½ watt.
R2, R3 .025 meg 1 watt.
R5 .02 meg. ½ watt.
R6 3000 ohms ½ watt.
R7 .05 meg. 1 watt.
R8, R9 1 meg. 1 watt.
R10 .1 meg. ½ watt.
R11 10 meg. ½ watt.
R12 .5 meg. potentiometer with switch.
R13 .25 meg. ½ watt.
R14 2 meg. ½ watt.
R15 .5 meg ½ watt.
R16 350 ohms 1 watt

SUNDRIES

2 small knobs and felt washers, 1 6.3 volt dial lamp, 2 5-tag, 1 4-tag, 1 3-tag and 1 2-tag mounting strips, small quantity 16 gauge B&S enamelled wire for RF chokes, aluminium scrap for brackets, PTIM coaxial cable for aerial lead, about 2yd shielded wire. 2 x ½in threaded stand off pillars, 1 3/8in i.d., 2 ½in i.d. and 5 3/16in i.d. rubber grommets, fibre or bakelite washers for insulating support bolts from supply internal plate, solder lugs and solder, nuts, bolts and lock washers; hook-up wire.

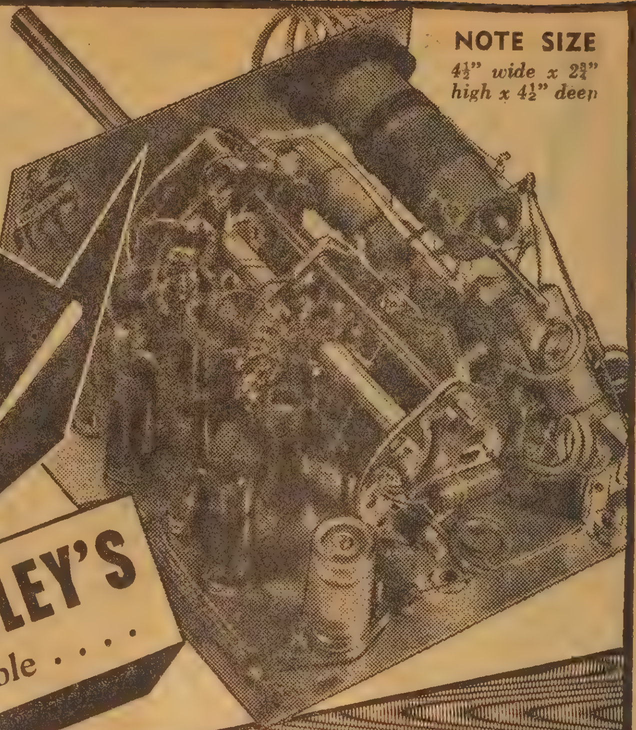


* Low DC resistance choke † Multiple unit (2 by 1000pf)

"1952 KARSET" VIBRATOR SUPPLY

The power supply circuit for the "1952 Karset". It is housed in a separate case and all components are assembled initially on a single plate, earthed to the lid at one point only. This is an important precaution against vibrator hash.

It's here!


NOTE SIZE
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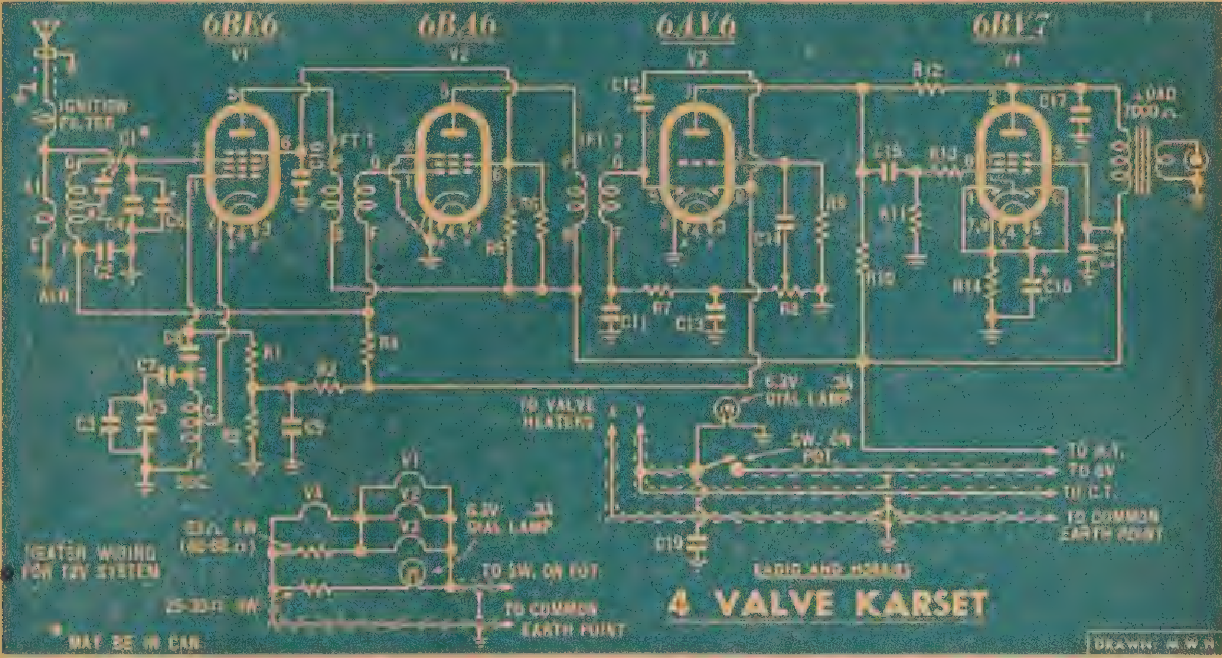
CIRCUIT DETAILS OF THE FOUR-VALVE KARSET


6BE6
V1
6BA6
V2
6AV6
V3
6BV7
V4
IGNITION FILTER
C1*
L1
AER
IFT 1
IFT 2
C12
R12
C17
LOAD 7000 Ω
C15
R13
R11
R10
R14
C16
R9
C14
R7
R8
C11
C13
R5
R6
R4
R1
R2
R3
C9
C7
C8
C3
C5
OSC
6.3V .3A DIAL LAMP
TO VALVE HEATERS
SW. ON POT
TO H.T.
TO 6V
TO C.T.
TO COMMON EARTH POINT
C19
HEATER WIRING FOR 12V SYSTEM
V1
V2
V3
V4
6.3V .3A DIAL LAMP
TO SW. ON POT
TO COMMON EARTH POINT
25-30 Ω 1W
* MAY BE IN CAN
RADIO AND HOBBIES
4 VALVE KARSET
DRAWN: M.W.H.

Excellent results are to be had with the four-valve "Karset", which has the additional advantage that it can be housed in a single case of moderate dimensions. Like the larger version, it can readily be adapted for 12-volt operation by connecting the heaters in series-parallel as shown and using a 12-volt vibrator and transformer.

Before jumping to conclusions, therefore, in relation to high tension voltage, check to see that the effective primary input is a full 6 volts. Check the resistance also of the high tension filter choke. Some are as low as 200 ohms, others run to 600 ohms, with a difference of some 20 volts in high tension output.

The rise in battery voltage when the car is in motion can be quite marked and is good reason for leaving some leeway in valve ratings.

Though opinions vary as to actual figures, it is regarded as more or less normal for cells under charge to run up to 2.5 volts each, making 7.5 volts for a 6-volt system and 15 volts for a 12-volt system.

This represents a rise of better than 20 pc and is enough to carry the high tension voltage from a nominal 250 volts to the limit of the valve ratings.

As might be imagined, poorly adjusted electrical systems can readily exceed this figure, leading to possible distress in the receiver — irrespective of make, type or brand. If a car receiver overheats in ser-

PARTS LIST

- 1 chassis 5¾in x 3⅜in x 1in.
- 1 Box 6in x 3½in x 8½in long with inside partition plate with ½in fold.
- 1 Base plate 5¾in x 3¼in for vibrator supply.
- 1 Car radio coil kit comprising high gain car aerial coil with tapped secondary, ignition suppressor coil, osc. coil to suit 6BE6 valve, two miniature 455 Kc IF transformers.
- 1 Miniature dial (MSL/48 B/C) to suit gang.
- 1 Miniature 2-gang tuning capacitor (C4, C5).
- 2 Gang section trimmer capacitors (C3, C6).
- 1 6 or 12-volt small size vibrator transformer with 250v 55mA secondary.
- 1 Synchronous vibrator cartridge, 6 or 12-volt to suit transformer.
- 1 15 henry 60mA filter choke (L1).
- 3 7-pin miniature valve sockets with shield cans.
- 1 9-pin miniature valve socket, 1 6-pin valve socket for vibrator.
- 1 Standard RF choke (may be in coil kit).
- 1 7in or 8in speaker, 1 miniature 5000-7000 ohm speaker transformer.
- 2 Chassis-mounting single contact plug and socket assemblies (Car radio type).

VALVES

1 6BE6, 1 6BA6, 1 6AV6, 1 6BV7.

CAPACITORS

C1 100 pf
C2 .1 mfd.
C3. Trimmer.
C4. Gang section.
C5. Gang section.
C6. Trimmer.
C7. 425 pf mica. (5%).
C8. 100 pf.
C9, C10. .1 mfd.
C11, C12, C13. 100 pf.
C14, C15. .01 mfd.
C16. miniature 25 mfd 40PV electrolytic.
C17. .005 mfd.
C18, C19. .25 mfd.
C20, C26. .01 mfd.
C21, C23. 8 mfd 525PV chassis-mounting electrolytics.
C22, C25. .5 mfd.
C24. 4700 pf.

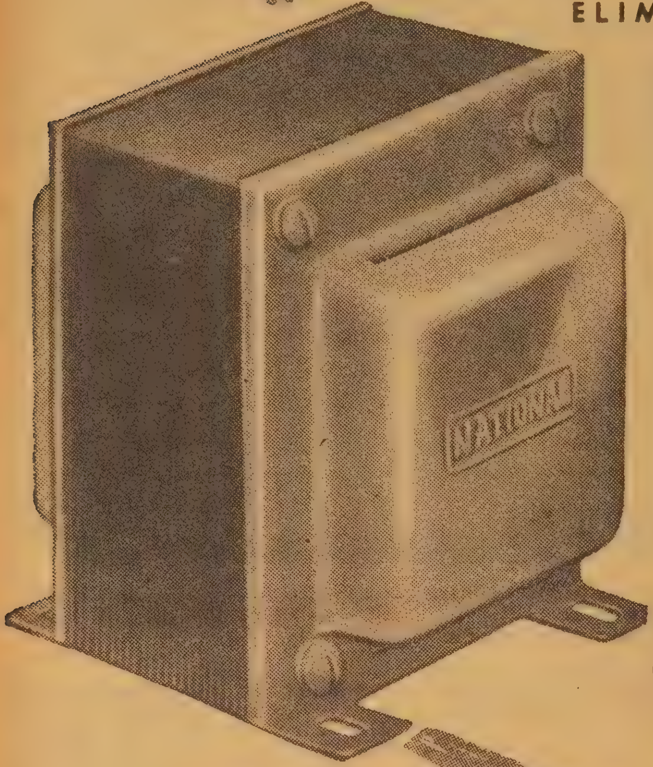
All 100 pf except C8 are UCC miniature. All tubular capacitors except electrolytics are TCC.

RESISTORS

R1 .02 meg.
R2 3000 ohms.
R3, R4 1 meg.
R5, R6 .025 meg.
R7 .1 meg.
R8 .5 meg. potentiometer with switch.
R9 10 meg.
R10 .25 meg.
R11 .5 meg.
R12 2 meg.
R13 5000 ohms.
R14 150 ohms.

SUNDRIES

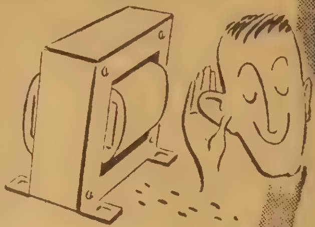
2 small knobs and felt washers, 1 6.3v .3A dial lamp, 1 5-tag and 2 3-tag mounting strips, 16 gauge enamelled wire for RF chokes (may be in coil kit), PTIM coaxial cable for aerial lead, about 3yd shielded wire, 1 ½in threaded stand off pillar, aluminium scrap for brackets, 2 ¼in and 3 ⅜in i.d. rubber grommets, 4 rubber mounting grommets ⅛in i.d., 4 1¼in by ⅛in bolts for vibrator base plate support, flat and lock washers, self-tapping screws, nuts, bolts, solder, solder lugs, hook-up wire, spaghetti, cable for battery connection and cable-mounting fuse holder (if desired).



THEY'RE QUIET . . .

LAMINATION HUM COMPLETELY ELIMINATED

This has been achieved in types up to 50mA's by sturdy one-piece clamps of which the mounting brackets are an integral part; and in the larger transformers by using metal covers and a one-piece clamp, both of heavy section to ensure absence of fatigue.



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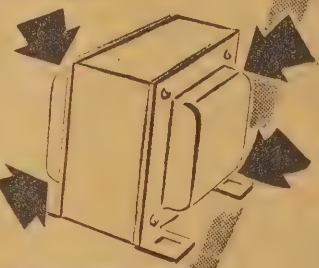

THEY'RE TOUGH

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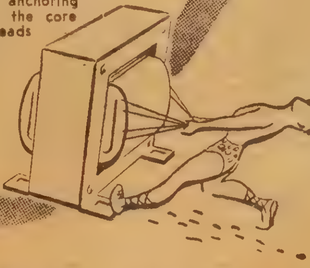

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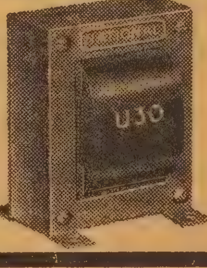

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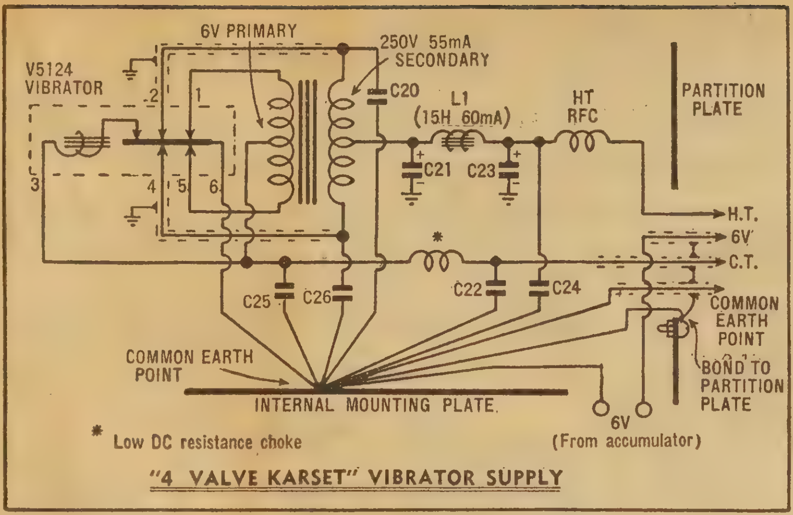

Here is a power supply circuit for a four-valve "Karset" shown on the previous page. It is very similar electrically but the transformer is slightly smaller than for the larger set, allowing it to fit into the available space.

vice, or seems prone to damage valves, it is advisable to check the battery voltage under varying conditions and take corrective steps, where necessary.

Don't forget, by the way, that all R & H Karsets to date use a synchronous vibrator system to save the extra drain of a valve rectifier.

Because of this, the transformer secondary leads should be connected only temporarily to the vibrator socket until the unit can be connected to a battery for a preliminary test. To test the supply, connect it with the "active" lead to the same pole of the battery which is active in your car.

If the high tension output is now negative instead of positive with respect to chassis, reverse the transformer secondary leads.

A possible problem with any vibrator power receiver is that of vibrator "hash" — a crackling, roaring noise which may be evident with the gain control advanced and the receiver not tuned to a station.

FROM VIBRATOR

It stems from the operation of the vibrator itself, which causes rapid bursts of current to flow through the wiring and transformer leads. The current bursts contain frequency components extending right through the audio and RF ranges. When picked up and amplified by the set, the interference appears in the speaker as a continuous crackle or roar, depending on how severe it is.

It diminishes when the set is tuned to a station simply because AVC action reduces the set's gain. It may peak at certain spots on the dial, either because of resonance effects in the filtering, or as a result of erratic tracking in the receiver tuned circuits.

Vibrator hash can generally be prevented by filtering from penetrating directly into the audio system of the set. It is not so easy, however, to keep it out of the RF and IF circuits.

It may reach these circuits by way of heater and high tension leads, since these must run between power supply and receiver. The normal precaution against this happening is to use filter chokes and bypass capacitators at strategic points.

However, it is important to realise that chokes can give rise to secondary effects in that, while suppressing interference from a lead, they can radiate it into space and therefore produce as much trouble as they eliminate.

Likewise, interference currents flowing to chassis through a bypass capacitor have to disperse themselves in the chassis and, in so doing, may penetrate the input circuit and be amplified all over again.

In other words, the position of chokes and bypass capacitators is often very important.

Radiation of interference from the vibrator circuit is normally prevented by shielding and by a specific method of construction, which prevents the vibrator circulating currents from flowing through shield partitions.

NO GREAT WORRY

By and large, readers who have followed the suggested layout have not had a great deal of trouble with vibrator hash, its level generally being well below strength of average signals. The worst cases of hash interference have invariably occurred where readers have tried to take short-cuts or varied our layouts to suit their own ends.

Unfortunately, due to the complex action of chokes, capacitors, shields and so on, it is next to impossible to "build out" the last vestige of hash and readers who want a completely quiet receiver may occasionally have to do a little experimenting.

The construction of the R & H "Karsets" lends itself to such treatment and there is no reason why they should not be completely hash-free, when installed in a car. This is certainly true of both sets featured here.

Our experience with these and other sets has focused attention on one or two special points which should be checked in particular. The observations only hold, however, if you have followed our specific instructions about assembly and wiring.

We must assume that you have mounted all components in the vibrator supply on a single assembly plate and returned all important earths to a common point. Further, that this plate is initially insulated from the outer case, so that it can be earthed to the case, if need be, at a single point.

We must assume, too, that you have followed our general layout arrangements and wired the heaters so that the "earthy" side is initially independent of the chassis. This allows the heater circuit also to be returned to earth at one point only, if need be.

In the 1952 Karset, the first point we suggest you try is the earthing system between the vibrator assembly plate and the power supply case. Do it with the aerial disconnected, or, better still, with a shorted plug inserted in the aerial socket.

The set, as originally described, has a lead to bond the receiver and supply cases passing through the plug and socket. Slip a screwdriver through a small hole in the power supply case and short the assembly plate directly to case.

PERMANENT BOND

Tune over the band and, if the has level appears to be lower, slip the power supply out of its case and make a permanent bond between the common earth point on the vibrator assembly plate, and the nearest point on the outer case. Drill a hole and instal a solder lug, if need be, making the bond with a scrap of copper braid.

This was advised as standard procedure in the original 1949 Karset. We also suggested it for the 4-valve set, although there is the difference in this case that only a single shield box is used.

Next check the bonding between the cases or between the power supply case and the chassis, if you are working with the set temporarily out of its box. It should make little difference whether the two are touched directly together or not.

Check the earth point on the filament network also. Normal procedure is to earth it at the socket of the first valve, other connections to earth being made only if they definitely reduce the hash level.

After this, we suggest you check the effect of the filter choke in the battery input line. It is intended primarily as a precaution

(Continued on Page 120)

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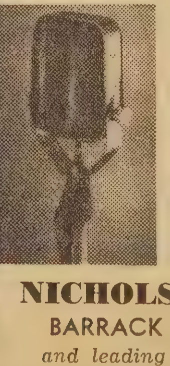
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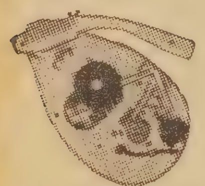

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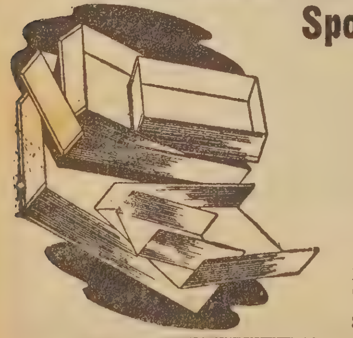

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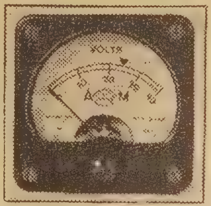

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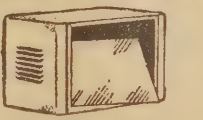

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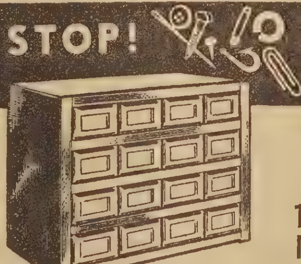

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GETTING YOUR AMATEUR LICENCE

This month we consider how you should prepare to answer questions about transmitters. In this article we have tried to summarize the essential points in the operation of standard oscillator and amplifier circuits. In our next issue we will continue the discussion with frequency multipliers, and possibly with the standard Class-C modulated amplifier.

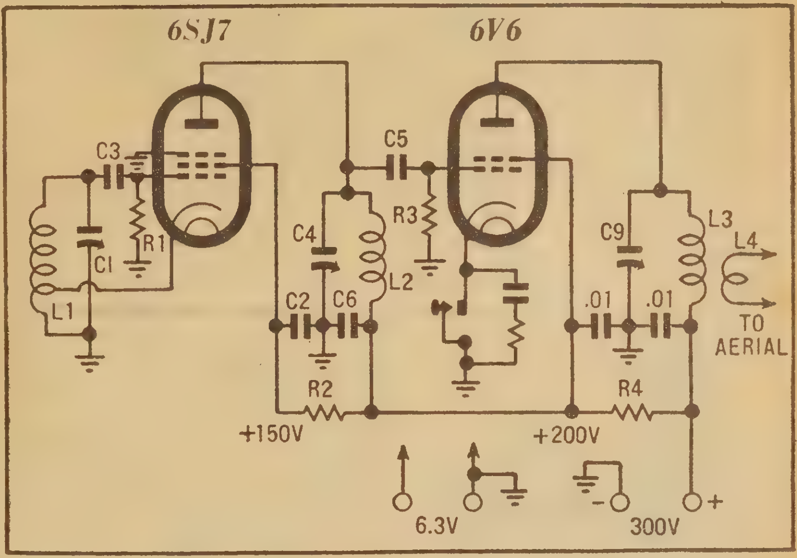

Fig. 1.—A typical amateur transmitter circuit using an electron-coupled oscillator driving a pentode power amplifier stage. A valve with an earthed suppressor is preferred for the oscillator although types with an internally connected suppressor are sometimes used. The circuit has been purposely simplified for the occasion.

There are many things an examiner might ask you about transmitters. He might ask you for a typical amateur circuit, and a brief description of how each section works. He might ask you to give some oscillator circuits, with explanations and comparisons. He might ask about a frequency doubler, or a modulated amplifier stage—probably using a triode, because this involves neutralisation, a subject all examiners love!

Now transmitters are fairly simple things as far as their general operating theory is concerned, but if you wish to follow each technical point right through to its conclusion, you will find yourself involved in some complicated matters.

SIMPLE EXPLANATIONS

Fortunately, the examiner isn't testing you for an engineering degree, and he won't expect you to produce long mathematical explanations and equations. In this article we are going to assume some knowledge of an examiner's mind (having played the role in our time in other spheres) and treat the subject in the manner we think the examiner will expect from you.

Once again, however, we stress the necessity of reading back into your reference books as much as possible, so that you fill in the background we cannot cover in the space available each month.

It might be wise at this stage to clear up some confusion which often appears in the beginner's mind about voltage, power, energy, and current.

In receivers, we don't normally talk about power amplifiers until we reach the output stage—until then we are interested more in voltage than power, and generally refer to valves as being voltage amplifiers.

The fact is that, in general, we don't get voltage without some flow of current as well, although in receivers it may be very small. In reality all valves are power amplifiers, because there is both voltage and current flowing in both grid and plate circuits. If we talk about power in connection with transmitters, whether amplifiers or oscillators, it is because the voltage and currents involved are appreciably larger.

OSCILLATOR POWER

Even a small oscillator can produce enough power, represented by the RF voltage and current, to light an ordinary pea lamp, and even to burn it out, as you will soon discover. This is not surprising when we remember that the plate voltage may be 250 volts or so, and the plate current available may be 20 or 30 milliamps. So we begin to think in terms of power rather than of voltage or current, but we should remember that, as Ohm's Law tells us, power is merely the product of these two. Sometimes we talk about power as being energy—rather a loose term but sometimes it helps to clear a picture in our minds.

The question requiring a circuit diagram of a transmitter is quite a common one, and it would be a good idea to assume it for the purpose of this discussion. We might be asked for a circuit and explanation of a two-stage job using a crystal oscillator and a neutralised triode, or perhaps a self-excited oscillator and a pentode.

These two circuits would include the main types of oscillators and amplifiers used by amateurs today.

WHAT IS A TRANSMITTER?

A transmitter is a form of electrical generator which produces oscillations at the frequencies we use for transmission, and after suitable amplification, if needed, passes them on to the aerial, which is the generator load. It is from the aerial that useful radiation takes place, and the transmitter's output power is absorbed in the task of setting up and maintaining a series of radio waves in space.

We have therefore defined the functions of our transmitter sections. The oscillator produces the initial oscillations, the amplifier amplifies them to the required degree, and couples the available output into the aerial system.

The first valve transmitters ever used were self-excited oscillators with tuned circuits to vary the oscillator frequency, and very unstable things they were, too! Eventually they gave way to crystal-controlled types, which were very much more stable.

Better design and construction today have given the tuneable oscillator a stability equal to that of the crystal. Most amateurs use a variable frequency oscillator (VFO) which allows them to operate at any desired spot within the amateur frequency bands. But the crystal type is still popular, particularly for VHF transmitters and various special oscillators.

In power amplifiers, triodes were used first because they were invented first. Today the pentode and beam power tube have found great favor, particularly with amateurs, because of their nigh power gain and because they often need no neutralising. On the other hand triode circuits are simple to use and frequently they are just as convenient as pentodes.

The two circuits shown here illustrate both types of oscillators and amplifiers, and we will deal with them in their order.

There are many kinds of oscillator circuit which you will find described in reference books. Many of them don't appear to have much in common at first glance, but if you examine them, and the explanations which go with them, you will realise that all valve oscillators depend on a few simple requirements.

VALVE MUST AMPLIFY

In the first place, the circuit can only oscillate if the valve is able to amplify. Any alternating voltages which appear at the grid of such a valve will be amplified and re-

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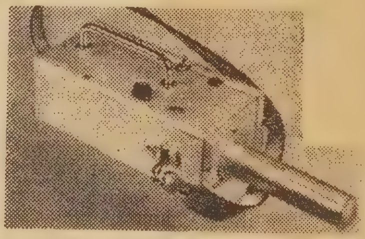

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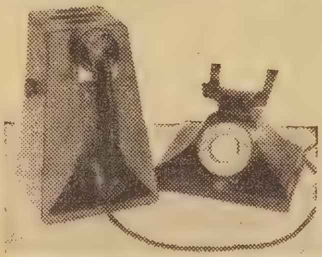

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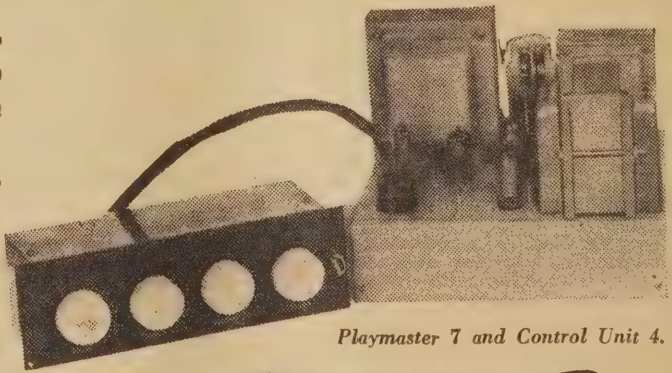

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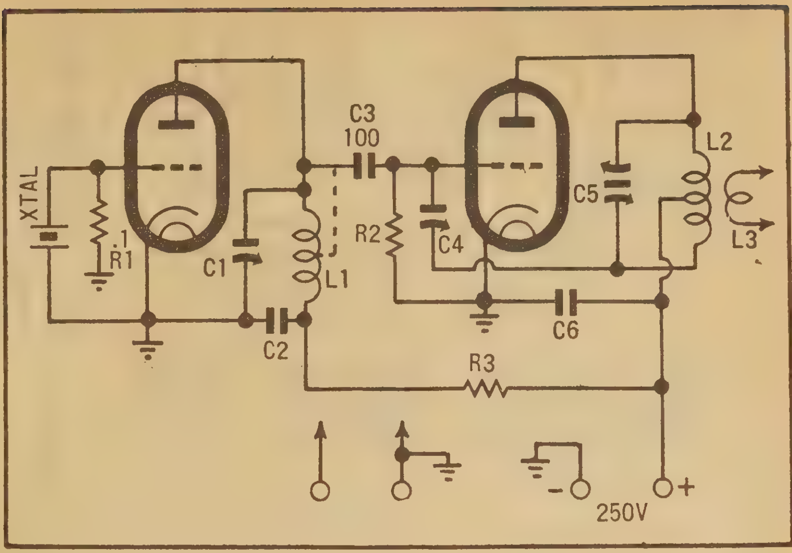


Fig. 2.—A simplified circuit of a triode crystal oscillator driving a neutralised triode amplifier. A split stator condenser is used to achieve better circuit balance than with a single type. If the moving plates of this condenser are earthed, an RF choke must be included between the coil centre tap and the voltage feed point and bypass condenser.

appear as still greater voltages in the plate circuit. Such a valve is an amplifier, but it is not yet an oscillator. What we want is some method of making the valve generate its own oscillations which, once started, will continue as long as required.

If we apply an alternating voltage to the grid of the valve, oscillations will be set up in the tuned circuits associated with it. But as soon as the voltage source is removed, the oscillations will die away very rapidly, and the circuit will revert to its original idle state. The power of the oscillations has been used up in overcoming the losses which are present in all electrical circuits, but they would have continued indefinitely had those losses not been present. If you like, you can imagine the losses as electrical friction. Unless more energy is supplied to make up for the amount they absorb, they will bring everything to a standstill, or as we have put it, an idle state.

If we can take some of the amplified output from the plate circuit of the valve, and feed it back into the grid circuit, using enough energy to overcome the grid circuit losses with a little bit over, that little bit will be amplified by the valve, appear once again in the plate circuit, and keep alive a continuous process of feeding back energy throughout the circuit.

The valve now does not need any further external voltages or "excitation" for all this to happen—it is now "self-excited", taking its input or grid requirements from the feedback circuit supplied by the plate.

POWER FROM SUPPLY

The energy or power required for all this comes from the high tension supply we apply to the plate from a battery or power supply. The initial "kick" to start it going comes from the tiny amount of energy supplied by movement of electrons through the valve. Initially this may be infinitesimal, but the amplification of the valve builds it up to a larger amount almost instantaneously, and the valve will oscillate for all practical purposes as soon as the plate voltage is applied.

The feedback from the plate must be of such a nature that it is in phase with the voltages initially appearing at the grid, or the valve will not oscillate. If you have ever built a single valve receiver with reaction, you will know that the reaction coil must be connected the right way round or the circuit will not work. Oscillators used for transmitting frequently use circuits exactly similar to those used in such receivers, but are generally supplied with higher plate voltage to develop more power. Oscillator output is invariably taken from the plate circuit because it is here that the oscillations are found, in their greatest magnitude. The power in the grid circuit is very much less.

GRID CURRENT

The power appearing in the grid circuit of an oscillator is enough to cause several milliamps of grid current to flow, for on the positive voltage peaks the grid will conduct after the manner of a diode, and the alternating voltage will be rectified. If we include a grid leak between the grid and cathode, with a grid blocking condenser where necessary, this grid current will flow through the resistor to the cathode, and bring about a voltage drop across the resistor. The potential at the grid end will be negative, as it always is at the plate end of a diode, and the grid will therefore be negatively biased.

By using the right value of grid resistor, which we can work out by Ohm's law, we can arrange to produce the correct amount of bias required by the valve to make it oscillate correctly, and to limit its plate current to the maker's specifications. In this respect it is interesting to note that the operating conditions for a valve oscillator are similar to those required for operation as a class C amplifier, although generally the voltages used are substantially lower for oscillator service.

The frequency at which the valve will oscillate will be that to which the tuned circuit is resonant. This circuit may be in either the grid or plate circuit, according to type, or it may be connected to both.

Having progressed to this point, we can now consider the operation of the oscillator selected for the transmitter circuit, for space does not allow an analysis of all oscillator circuits, which you will find covered in your textbooks.

ELECTRON-COUPLED OSCILLATOR

This oscillator is known as the electron-coupled oscillator, and is a good one to include in your circuit because, properly built, it is quite suitable for use in practice, and is found in many transmitters.

The valve used is a pentode, preferably with a suppressor which can be earthed to provide good shielding between the plate and the rest of the valve.

The actual oscillator plate is the screen of the valve in this case. The tuned circuit is connected to the grid, and feedback is obtained by tapping the cathode a few turns up the coil from the earthed end.

Because the electrical return path for both grid and plate circuits is to the cathode of the valve, this bottom portion of the coil is common to both circuits, and they are coupled together through it. The circuit would work just as well if the cathode were earthed through a small coil coupled closely to the grid coil, but the tapping method is simpler. This bottom portion serves to provide the feedback from plate to grid circuit, and make the valve oscillate.

The screen is bypassed to earth through C2 and fed with voltage from the HT supply through R2. A grid leak R1 provides grid bias for the valve, and C3 is the blocking condenser.

The oscillator frequency is determined by the resonant frequency of L1 and C1.

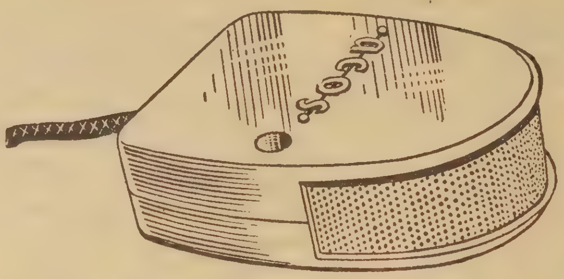
Power output from the valve is taken from a tuned circuit C4-L2 connected to the plate. It may be tuned either to the same frequency as the oscillator, or to twice, three times, or even four times this frequency. The plate section of the valve operates independently of the oscillator, but is coupled to it because both sections use the same electron stream flowing between the plate and the cathode. This is why the circuit is called "electron coupled".

The main advantage of this circuit is that the shielding of the plate by the suppressor and the earthed screen prevents serious interaction between the tuning of the plate and grid circuits, although there may be a small amount when both are tuned to the same frequency. The amount of power fed to the next stage can also be varied quite materially without much effect on the grid circuit, because with a pentode changes in plate voltage cause only small changes in plate current. The screen is virtually the controlling electrode.

OSCILLATOR STABILITY

Every precaution should be taken to ensure stability of the oscillator frequency. The main things to watch are these:—

1. Provision of a high-Q circuit. At resonance, the inductive and capacitive reactances in the tuned circuit balance out, and only the re-



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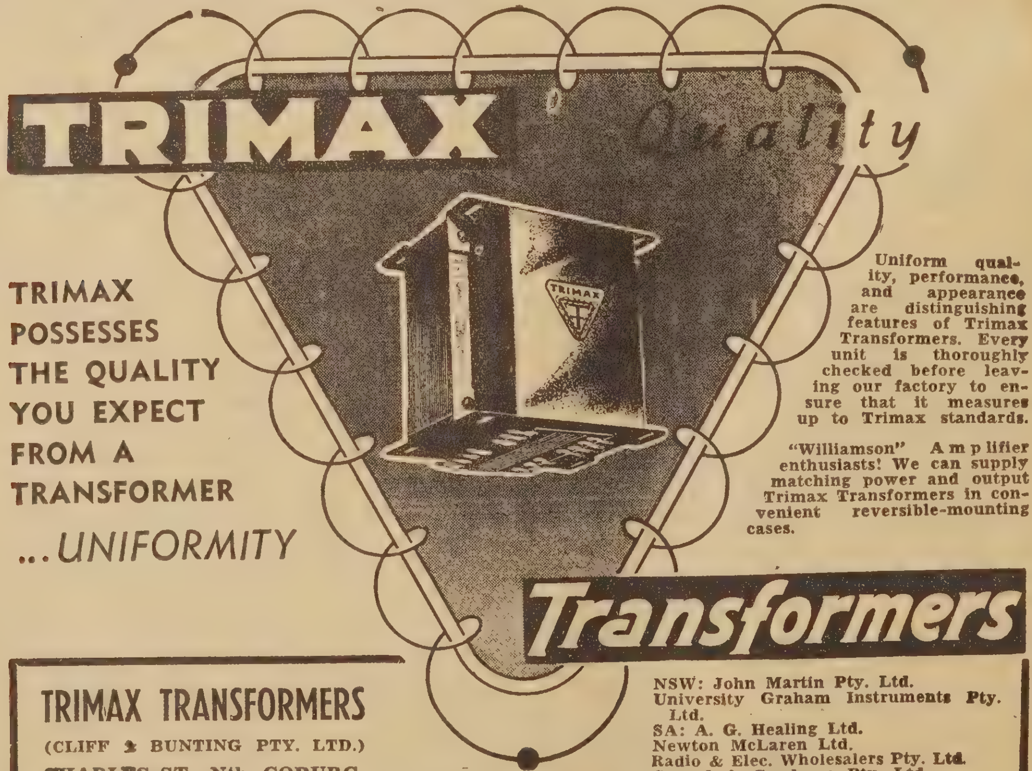

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sistance remains as an impedance to current flow. For high-Q, this resistance must be as low as possible. As the losses in a capacitor are lower than in an inductance, we must use a high-C circuit—a large condenser value and a small coil, which should be wound with heavy wire on a former with a low dielectric constant such as ceramic. Often most of the capacitance is a fixed value, with a small variable condenser in parallel to cover the desired tuning range. A high-Q circuit is the most important requirement for stability.

2. Extremely rigid wiring and component mounting. There is always some capacitance between these and earth, and movement will change its value and cause small changes in frequency. The high-C tuning circuit helps to minimise the amount of detuning which may be caused by variations in "stray" capacitances because its own capacitance is so large.

3. Maintenance of the oscillator circuit, particularly the coil, at an even temperature to avoid heat expansion or contraction. This calls for good ventilation and isolation from radiated heat from the valve.

4. A constant voltage supply, particularly for the screen. A voltage regulator tube to control it would be a good thing.

5. Light loading of the output circuit. The oscillator should always be followed by a valve whose input requirements are much lower than the amount of power the oscillator can provide. This allows the oscillator valve to run cooler with low voltages and current drain and reduces inter-action between it and the grid circuit of the driven valve to a minimum.

CRYSTAL OSCILLATOR

The second type of oscillator about which questions may be asked is the crystal oscillator, a simple version of which appears in Fig. 2.

By far the majority of transmitting crystals are made of Quartz cut into small slabs with specific relationship to one or more of the natural axes of the crystal structure. Their usefulness lies in their "piezo-electric" qualities which allow them to vibrate physically when excited by an alternating voltage whose frequency is the same as or related to the natural frequency of the crystal.

The crystal frequency is determined partly by its exact relationship to the natural axes, but mainly by its thickness. Crystals used for transmitting vibrate at right angles to the large faces. These faces must be perfectly flat and parallel, the tolerances becoming smaller as the crystal becomes thinner and its natural frequency higher. They are normally mounted in a holder between two smooth, flat plates, either in contact with the crystal surfaces or with a very small air-gap between them to reduce the capacitance between the plates.

VALVE NEEDED

It is sometimes believed that in a crystal oscillator circuit, it is the crystal which is the source of oscillations. This is quite incorrect: the circuit is really a crystal-controlled oscillator, and unless associated with a valve having a feedback path from plate to grid, there will be no oscillations generated.

The electrical equivalent of a crystal is a series resonant circuit having an extremely high Q, and if includede in a suitable circuit, it will behave exactly like a coil and condenser would behave if we could design such a combination to have an equal value of Q.

In practice, this is quite impossible, but it is mainly the high Q of the crystal, together with its physical stability, which results in a very stable circuit.

But the other factors as listed for the self-excited oscillator will also cause small changes in the frequency of the crystal-controlled oscillator, although to a lesser degree. Adding capacitance across the crystal and its holder, for instance, may lower frequency by several Kc at 3.5 Mc. Temperature change of the crystal will cause a slight drift except with special "cuts".

The crystal circuit therefore is not absolutely stable. It is no more stable than a well-designed valve oscillator, but this high degree of stability is much easier to obtain because of the initially higher Q of the crystal.

The simplest of crystal oscillators is shown in Fig. 2. The crystal is connected between a triode grid and earth, with a grid leak to complete the grid return, as the crystal will not pass DC.

In the plate circuit we have a tuned circuit which will include the crystal frequency in its tuning range. C2 is an RF return path for the plate circuit, and its position allows the rotor plates of the condenser C1 to be earthed.

There is no coupling circuit needed here for feedback, because this takes place through the small value of capacitance between the plate and grid of the valve itself. When the plate circuit is tuned near enough to the crystal frequency for appreciable voltages to appear across it. feedback takes place and the circuit will oscillate.

PLATE TUNING

In practice, the plate circuit is always tuned a little higher in frequency than the crystal. The oscillator output is greatest when the two frequencies are nearly the same, at which point the oscillations suddenly cease.

The reasons for this are concerned with the electrical constants of the crystal and feedback circuits, and we need not be concerned with them at the moment.

In an oscillator where two frequency conscious circuits are concerned, the higher Q circuit will always set the frequency. For this reason, the frequency of a crystal-controlled oscillator is virtually independent of the tuning of the plate circuit.

The most popular valves for crystal oscillators are pentodes, because their high sensitivity provides high output for low RF currents through the crystal. If a well-shielded pentode is used, the plate to grid capacitance may be too small to provide enough feedback. In such a case, a small amount of capacitance must be provided from plate to grid external to the valve to make the circuit oscillate.

In amateur practice, simple crystal oscillators are generally replaced by more useful circuits such as the Tri-tet—a variation of the electron-coupled oscillator operating as an efficient oscillator and frequency multiplier using only one valve.

The function of the power amplifier is to receive output from the oscillator, to amplify it to the desired degree, and feed it to the aerial system.

ISOLATOR STAGE

The aerial can be connected directly to the output circuit of an oscillator, but except occasionally in the case of a crystal-controlled oscillator, it is not considered good practice in the interests of stability. One or more amplifier stages are generally used to isolate the oscillator from the aerial.

The amplifier valve may be any type — triode, pentode, &c. — which can be driven by the available oscillator output and which will produce the amount of power we want. For purpose of illustration we have shown a pentode amplifier in Fig. 1.

RF amplifiers of the type shown are invariably operated in "Class C" in order to obtain maximum output without overheating the plate of the valve, in other words for high amplification efficiency.

This means that the valve uses a high grid bias — approximately twice the value needed to cut off the plate current. The grid is then supplied with enough RF voltage to exceed the bias voltage on positive peaks.

GRID BIAS

During this short positive period, the grid will conduct and grid current will flow. As with the oscillator, the flow of grid current develops a DC potential across the grid resistor — being negative at the grid — and this negative voltage may be used as the sole source of grid bias.

Thus the oscillator circuit must do two things — provide a high enough voltage to the amplifier grid to overcome the grid bias and drive it positive for short periods of each operating cycle, and to provide the necessary RF power absorbed by the valve during the time grid current flows.

The loading of the oscillator plate circuit—the generator—by the amplifier grid circuit—the load—is just as important for maximum transfer of energy as in any other electrical circuit. The effective grid circuit impedance will be determined by the operating bias voltage and the amount of grid current which flows during the positive portion of the driving cycle. In most amateur cases, it will be high enough in value to allow grid connection to the oscillator plate without undue loading of the tuned circuit.

Some valves will have a low grid impedance. If these are driven by an oscillator having a medium or high plate impedance, it is common practice to tap the grid connection part way down the coil. In general, however, practical oscillators have enough reserve power to overcome the loss due to a mis-match, and the plate-to-grid capacitive coupling is usually sufficient until we come to power stages handling 100 watts or so. Coupling links between tuned circuits are then preferred to obtain the most efficient matching.

USE OF PENTODE

If the amplifier is operated at the same frequency as the oscillator, it will probably oscillate as a self-excited oscillator without appropriate precautions, as there is a

(Continued on Page 113)

DO YOU WANT TO

MAKE EXTRA MONEY

CAN YOU USE

EXTRA CASH

MAKE
BABY-SITTERS
OLD-FASHIONED

INSTAL THE
"Q-PLUS" EXTENSION
SPEAKER
AS A

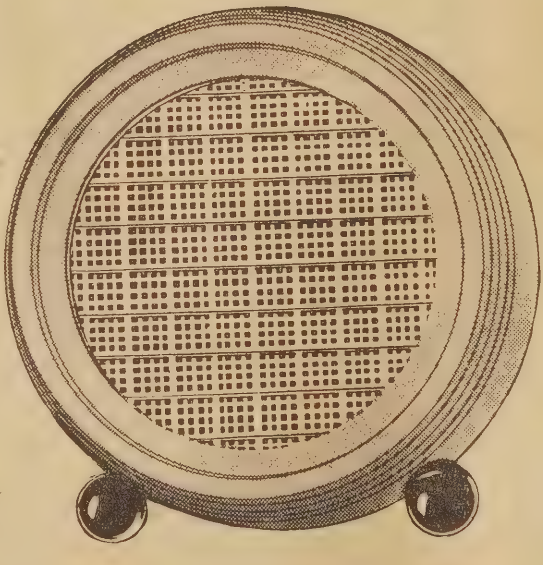
CRYAPHONE!!

INSTRUCTIONS

CASE A

Take any radio set with pick-up terminals. "Q-PLUS" extension speaker, leads, etc. Fit any high impedance speaker transformer preferably 10,000 ohms or more voice coil leads to voice coil and primary to screened wire to radio set which may be placed where it is desired to hear baby—when baby cries it may be heard in speaker.

Simple and parts cost about 60/- only



INSTRUCTIONS

CASE B

This should be used where the parents are next door or the distance from baby to parents is excessive—2 "Q-PLUS" extension speakers are needed, 1 high impedance transformer.

Connect speaker to transformer and run short shielded lead to P.U. terminals. Leave set nearby and run extension speaker from set in normal way to where it is required.

This set up retails about £6.

AND DON'T FORGET THESE OTHER USES

- ★ **FROM YOUR CAR RADIO—TO THE BEACH**
- ★ **USE AS ABOVE FOR HOME INTER-COMM UNIT.**
- ★ **EXTEND YOUR RECORD PLAYER TO THE GARDENS AND HALLS AT YOUR NEXT PARTY**

ETC. ETC. ETC.

HOBBYISTS SERVICEMEN!

THESE "Q-PLUS" LINES CAN EARN YOU EXTRA CASH, TOO!

With these extra "Q-PLUS" LINES—Don't sit down and let the big manufacturers do it—you can earn extra cash in the forthcoming summer season—hop to it—many are doing it now!

THE "Q-PLUS" LOOP-STICK -- TYPE LAI

When you move your mantel set from one room to another?—Yes, with a trail of broken vases from that trailing indoor aerial. Be modern! In the metropolitan area indoor aerials are obsolete—old fashioned. Simply replace the aerial coil with a "Q"-Plus Loop Stick. All you have to do is to suitably mount the stick anywhere on the radio — on the cabinet, chassis, etc. Replace the grid and AVC leads from the old aerial coil onto either two of the loop stick and presto! No more aerials. **ONLY 23/9 RETAIL, TOO!**

COUNTRY FIRE AUTHORITY—SMALL FISHING CRAFT BANDS,

Instead of the normal S/W band on DW and DWR "Q"-Plus tuning units—you can now have any band you require to suit the above bands—usually 2-7.0M/cs, as well as the normal short wave band. Many country people and small ship-owners require these bands on their radios—Fit them and make your hobby a paying one. These units have to be specially ordered and are slightly dearer than the normal unit.

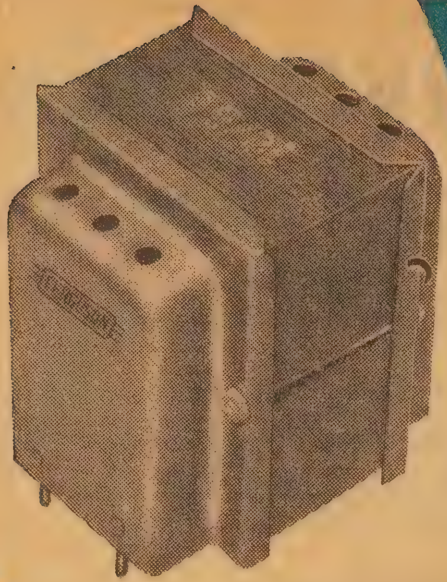
NOW RELEASED! THE TRIPLE-WAVE "PRE-FAB"

NO ALIGNMENT NECESSARY—Except the IF channel. Comes completely wired with gang condenser, valve sockets, etc, simply drop into chassis, connect filaments, B plus plus IF plate and there you have it. Send stamped, addressed envelope for full details. £12/12/- plus s/tax.

"Q-PLUS" DATA BOOKS

We still have a limited quantity of these available—Do not miss out as it may be years before this useful data book is reprinted. Send 2/6 to:

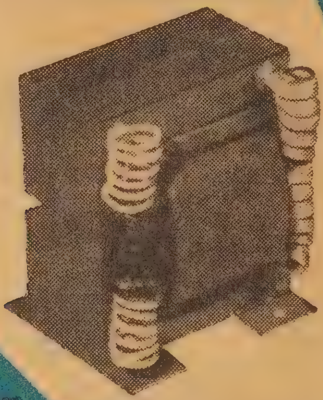
R. W. STEANE & CO. PTY. LTD. AUBURN, VICTORIA



POWER TRANSFORMERS

CODE NO.	Primary Volts	HTV ASIDE	HT mA	FILAMENTS
PF 185	240	150	30	6.3V/2A
PF 299	240	285	40	6.3V/2A 5V/2A
PF 300	240	325	40	6.3V/2A 5V/2A
PF 201	240	225	50	6.3V/2A
PF 152	230 240	285	125	6.3VCT/3A 6.3V/2A 5V/2A
PF 151	230 240	285	60	6.3V/2A 5V/2A

From the transformer specialist with the largest range of Power Transformers in Australia you may select the types to suit your requirements upright or flat.



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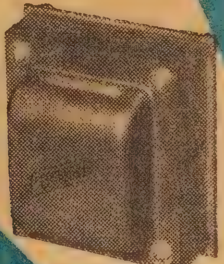

POWER OUTPUT QUALITY

VIBRATOR TRANSFORMERS

CODE NO.	PRIMARY VOLTS	D.C. VOLTS	O'PUT mA	BUFFER FULL SEC.
VT 102	6	150	25	.005
VT 103	6	200	50	.005
VT 104	6	250	60	.005
VT 112	12	200	50	.005
VT 105	12	250	60	.005
VT 116	24	250	60	.005

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JA 8491 (6 LINES)

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FERGUSON LANE,
CHATSWOOD.

P.A. RANGE 50-8000 cps Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	12.5, 8, 2.3	64/3		OP-1
10	5000, 2500 SE	5, 2.7	65/4		OP-33
10	5500 SE	3.7	72/1		OP-41
10	30,000 20,000 14,000 10,000, 7000, 5000, 2500 PP	2.3	65/2	Universal Test Loud Speaker	OP-53
10	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	72/1		OP-54
10	5000, 2500 SE	15.	65/4		OP-39
10	10,000 PP	15, 8.4, 2.3.	72/1	5W Cath Amplifier	OP-85
10	7000 PP	Any ONE of following impedances—15, 12.5, 8.4, 2.3, 2.	72/1	9W Cath Amplifier	OP-92
15	5000 PP	12.5, 8, 2.3.	99/1		OP-2
15	6600 PP	12.5, 8, 2.3.	99/1		OP-3
15	10,000 PP	12.5, 8, 2.3.	99/1		OP-4
15	10,000, 6600, 5000 PP	12.5, 8, 2.3.	99/1		OP-5
15	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/5		OP-55
15	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-56
15	10,000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-57
15	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	106/8		OP-58
25	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	133/10		OP-59
32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	171/-		OP-60
60	3800 PP	17.6	166/8		OP-36
60	3800 PP	100, 75, 50, 25, 10, 5, 2.	195/5		OP-61

P.A. RANGE 50-8000 cps. Output to Line

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	500	64/3		OPIA
10	5000, 2500 SE	500, 250, 125	74/3		OP-44
15	5000 PP	500, 250, 125	99/1		OP-6
15	6600 PP	500, 250, 125	99/1		OP-7
15	1000 PP	500, 250, 125	99/1		OP-8
15	10,000 PP	500, 250, 160, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	117/4		OP-8M
15	10,000, 6600, 5000 PP	500, 250, 125	99/1		OP-9
15	5000 PP	600, 300, 200, 150, 130, 100, 75, 50	114/10		OP-34
15	8000 PP	600, 300, 120, 60, 30	199/10		OP-50
25	5000 PP	500, 250, 125	119/7		OP-10
25	6600 PP	500, 250, 125	119/7		OP-11
25	10,000 PP	500, 250, 125	119/7		OP-12

P.A. RANGE Cont.

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
25	10,000, 6600, 5000 PP	500, 250, 125	119/7		OP-13
25	10,000 6600 PP	500, 4000, 8.4, 2.2	164/1	Cutting and Playback Amplifier	OP-35
25	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	199/10		OP-38
32	5000 PP	500, 250, 125	144/11		OP-14
32	6600 PP	500, 250, 125	144/11		OP-15
32	6600 PP	500, 250, 166, 125, 100, 83. 5, 71.5, 62.5, 55.5, 50	148/9		OP-15M
32	10,000 PP	500, 250, 125	144/11		OP-16
32	10,000, 6600, 5000 PP	500, 250, 125	144/11		OP-17
32	6600 PP	140, 70	171/-		OP-48
60	3800 PP	500, 250, 125	168/8		OP-18
60	3800 PP	100, 75, 50, 10, 5, 2	195/5		OP-61
80	6400 PP	500, 250, 125	207/-		OP-37
105	8800,6000 PP	500	299/-		OP-49
150	11,600 8400 PP	500, 250, 166, 125	384/1		OP-20

HI-FI RANGE 30-15000 cps. Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
5	5000 SE	Any ONE of the following impedances 15, 12.5, 8.4, 6.5, 2.1	67/6	4W Baby Playmaster	OP-24
10	3250 SE	12.5, 8.4, 2.3	101/2	R & H Vox Major	OP-23
10	5000 SE	2	92/-	For Rola 120x Speaker	OP-113
10	5000 PP	2	92/-	For Rola 120x Speaker	OP-117
10	6600 PP	2	92/-	For Rola 120x Speaker	OP-119
10	8000 PP	2	92/-	For Rola 120x Speaker	OP-118
10	10,000 PP	2	92/-	For Rola 120x Speaker	OP-112
15	5000 PP	12.5, 8, 2.3	147/2		OP-19A
15	10,000 PP	15, 3.75	152/11	10W Playmaster	OP-63
15	10,000 PP	12.5, 3.125	152/11		OP-64
15	10,000 PP	8.4, 2.1	152/11		OP-65
20	4500 PP	15.5, 12.5, 8.6, 2.7, 2	134/4	15 & 32W Cathamplifiers	OP-51

Output to line

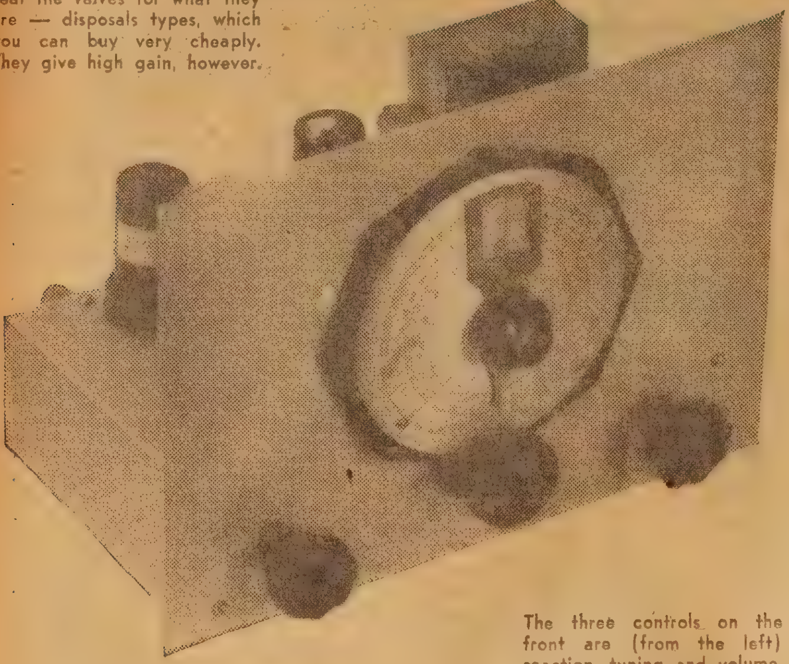
Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
10	3250 SE	500, 250, 125	101/2		OP-22
15	5000 PP	500, 250, 125	147/2		OP-19B
15	10,000 PP	500, 125	152/11		OP-62

SPECIAL HI-FI RANGE 20-30,000 cps.

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
15	10,000 PP	8.4, 2.1	180/11	For Williamson Amp.	OP25/8.4
15	10,000 PP	10, 2.5	180/11	For Williamson Amp.	OP25/10
15	10,000 PP	12, 3	180/11	For Williamson Amp.	OP25/12
15	10,000 PP	15, 3.75	180/11	For Williamson Amp.	OP25/15
15	10,000 PP	16, 4	180/11	For Williamson Amp.	OP25/16
15	10,000 PP	40, 10	180/11	For Williamson Amp.	OP25/40
15	10,000 PP	250, 62.5	180/11	For Williamson Amp.	OP25/250
15	10,000 PP	500, 125	180/11	For Williamson Amp.	OP25/500
15	5000 PP	8.4, 3.7	192/5		OP-66
15	5000 PP	15, 6.5	192/5		OP-67

ENGINEERED **TO-DAY** FOR **TO-MORROW'S** REQUIREMENTS

Labels and spots of paint reveal the valves for what they are — disposals types, which you can buy very cheaply. They give high gain, however.



The three controls on the front are (from the left) reaction, tuning and volume. The dial is an old-style vernier type which suits the purpose very well. You may be able to locate something like it or buy one of the modern equivalents from suppliers carrying stocks intended for amateur use.

A SET FOR YOUNG DX'ERS

Here is a set that should have a very wide appeal — cheap enough for our younger readers, simple enough for a beginner, yet capable of really excellent results. It can be used with phones or speaker, as you please, and will give endless pleasure on both the broadcast and the shortwave bands.

by Neville Williams

REACTION to the various small sets we have described of late has made it abundantly clear that there are plenty of readers who are interested in articles of this type. To some, small sets are a diversion, a challenge; to others a step towards bigger things in the future.

Though working every day among radio gear, we got quite a kick out of our "De-Luxe Crystal Set" a couple of months back, and the "Loopstick One" the month before that. Then there was the little one-valve job, in the last issue, running from two or three torch cells. All have their place in the scheme of things, appealing to one group of readers or another.

MORE AMBITIOUS

This present set is more advanced in design than the usual beginner's set and is intended for those who are keen to listen on a wider scale. It is, in fact, the kind of set most of us used at one time or another before we got around to building a full-scale superhet.

There is a difference, however. In place of the battery triodes and screen-grid tubes that we once had to use, the modern experimenter has available a whole range of valves boasting very high figures of gain.

It's a revelation, in fact, to see what a couple of these valves can do, particularly if adequately powered from the mains.

In approaching the design of this set our basic idea, then, was to produce a traditional kind of "Reinartz" circuit, but built around a couple of high-gain valves.

With the aid of plug-in coils we reckoned that it should provide complete and effective coverage of the shortwave bands at headphone strength. In this rôle it would be just the set for a beginner wanting to explore the bands and possibly to get in some Morse practice for the AOCP exam.

At the same time it should have enough gain and output to drive a loudspeaker on strong signals, being thus suitable for ordinary listening in the "den".

PERFORMED WELL

It is only right to say that the set lived right up to our expectations—and so should the one you build!

Having made up the original in the workshop, checked the voltages and "pruned" the coils with the aid of a signal generator, we wrapped it up and took it home for a couple of evenings.

Using only a few feet of aerial, all the local stations could be tuned at ample speaker strength. In fact, the volume control had to be turned well back on the stronger ones.

On the shortwave bands, using earphones, each tuning coil brought to light a complete array of signals. There was no question of counting or identifying them, but they ranged from international programs at very loud volume, through a variety of amateur phone stations to a countless number of Morse and telegraph signals.

Right at the start we had to make a choice about valve types and components.

These days, miniature parts are all the fashion and, using them, we could easily have gone ahead with the design of a kind of "miniaturised marvel".

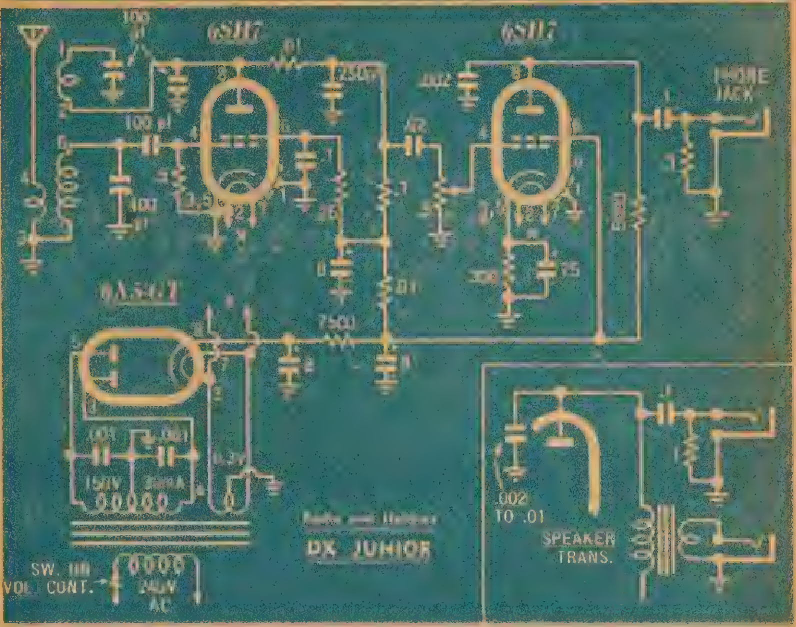
However, from the beginner's point of view, the disadvantage of such a scheme is that miniature parts are seldom available at "bargain prices". They have to be bought new, plus sales tax, plus everything!

SURPLUS STOCKS

On the other hand, we've seen plenty of surplus full-sized components on offer lately and every issue of Radio and Hobbies carries long lists of disposals valves at much less than the regular retail price. What experimenter could possible pass them by?

Looking over the valve lists, we reckoned that the 6SH7 would be the best choice for a small set of the type

IDEAL SET FOR YOUNG DX FANS



Here is the complete schematic circuit. Though 6SH7 valves are recommended, other RF pentodes could be used, in most cases without any change to the constants. If you want to use the set for speaker reception on the broadcast band, we suggest you wire the output stage as shown in the appended diagram, using two jacks, one for the phones and the other for the speaker voice coil.

we had in mind. It fits the standard octal socket and has characteristics virtually identical with those of the miniature 6AU6. What's more, it's available from several advertised sources at 7/6 a time.

Various other types would give equivalent results and you may already have one or two of them among your collection of bits and pieces. Some require special sockets, some have special heater ratings, some are large, some are small.

If you can get around such possible difficulties, just about any RF pentode is a candidate for use in the set, whether it be of the variable-mu or the sharp cut-off variety.

OTHER VALVES

Valves with lower figures of transconductance than the 6SH7 will give somewhat lower gain. Those with higher transconductance may give a little extra gain but be more critical to control, in terms of reaction and stability.

Looking now at the circuit, you will note that the first 6SH7 is used as a conventional regenerative detector, feeding a second one as an audio amplifier and output stage. There is therefore only one tuned circuit to worry about at the front end of the receiver.

This provides a problem in itself. In view of the role the set is intended to fill, it seemed logical to follow the time-honored practice of providing it with plug-in coils. To this end, we have numbered the various connections on the circuit to correspond with a convenient arrangement when 6-pin formers are used. These have been available commercially but any formers having five or more pins could be used equally well. You will need full-sized formers to carry the broadcast coil and the one in the range next to it, but the other three can be wound quite well on old 1¼in valve bases.

We'll have more to say later about winding the coils.

For general coverage, the normal procedure is to use a full-sized tuning capacitor, as shown in the original set. Most of these have a maximum value of just over 400 pF and will tune across the broadcast band in one sweep. In fact there will be something to spare at both ends of the range with the coil data given later in the article.

A PROBLEM

On the shortwave bands, wide coverage becomes as much an embarrassment as a convenience. While it allows one to search across wide sections of the spectrum, it also means that individual stations occupy very little space on the dial. Unless the tuning is done very carefully, some of the weaker ones at least can be missed altogether.

The same problem is seen in commercial dual-wave receivers, where the tuning on the short-wave bands is normally quite critical. To retain general coverage of the bands and yet spread out the stations for easy tuning is no simple matter. It involves things like tapped coils, extra switch positions, series capacitors in the tuning circuit and so on.

Though we have provided for bandspreading on a few odd occasions, we decided this time to put the emphasis more on simplicity. As you see it, therefore, the set has a standard type of tuning capacitor and covers the full range of frequencies in wide sweeps between about 500Kc and 32 Mc.

The very wide coverage on each band is accounted for partly by the fact that there is a minimum of stray capacitance across the tuning circuits and no parallel trimmer, as normally used in a superhet for alignment purposes.

Thus the mere connection of a trimmer, screwed about halfway in, in parallel with the tuning gang will restrict the coverage at the high frequency end of each band, reduce the overlap and spread out the tuning accordingly.

Whether it is worthwhile worrying about, however, is debatable, particularly as it may jeopardise the chances of tuning right to 30 Mc.

Conversely, a capacitor in series with the tuning gang will limit the coverage toward the low frequency end of each range and afford some bandspread as a result. The one argument against this step is that it

PARTS LIST

(Note: Components and dimensions are as used in the original receiver. Substitute components may be used in many positions but may influence dimensions, layout and other details.)

1	Chassis 8 x 5 x 2in.
1	Metal panel 9 x 6½in.
1	Vernier dial to suit.
1	100 pF. reaction capacitor.
1	0.5 meg. potentiometer with off-on switch.
2	(or 3) knobs to suit.
1	Single-gang tuning capacitor, AWA or similar. (Normally 400 approx. pF. but smaller type can be used for amateur band coverage only. See text.)
1	Reduction spindle ⅜in to ¼in (if necessary).
1	Power transformer, 150 volts per side, 30mA, 6.3v, 2A.
3	Octal sockets (or to suit valves selected).
2	6SH7 valves, metal or glass (or substitute types).
1	6X5-GT or other indirectly heated rectifier.
1	6-pin valve socket (or other to suit plug-in formers).
5	1¼in diameter plug-in coil formers. (State number required, see text).
2	Terminals, red & black.
1	Earphone jack (or 2 if necessary).

CAPACITORS

3 8 mfd 350PV electrolytics. 1 25 mfd 40PV electrolytic. 2 0.1 mfd tubular. 1 .02 mfd tubular. 1 .002 mfd mica. 2 .001 mfd mica. 1 .00025 mfd mica. 2 .0001 mfd mica.

RESISTORS

1 0.5 meg, 1 .25 meg, 2 0.1 meg, 2 10,000 ohm, 1 5000 ohm, 1 300 ohm (all half-watt rating), 1 7500 ohm 1W.

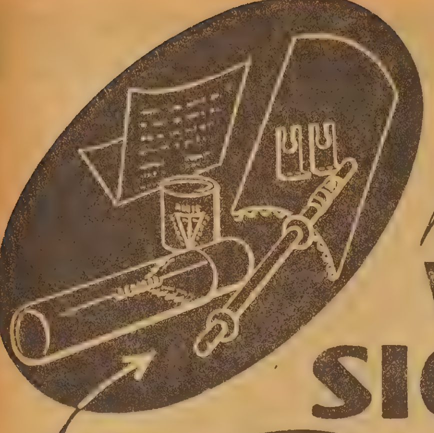
SUNDRIES

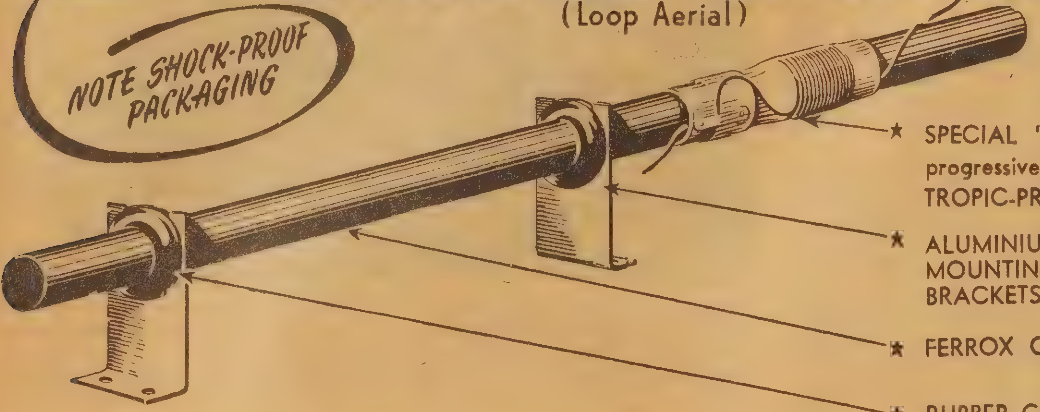
Winding wire for coils, grommet, power flex and plug, hook-up wire, solder, solder lugs, nuts and bolts, 1 4-position, 1 5-position tag strip.

Modernise your portable

WITH THE AEGIS SIGNAL MAGNET

(Loop Aerial)





- ★ SPECIAL "HI-Q" progressively-wound TROPIC-PROOF COIL
- ★ ALUMINIUM MOUNTING BRACKETS
- ★ FERROX CUBE
- ★ RUBBER GROMMETS take care of shock, etc.
- ★ OVERALL Dimensions
  8" long
  3/8" diameter
  1 5/8" deep (with brackets in position)

Supersedes loop aerials! This 1955 model Aegis component is a real "MUST" for portable radios. With this device sensitivity and selectivity are generally improved. The ferrox cube rod has an extremely high degree of permeability and radio frequency waves actually divert from their normal path to pass through this rod, making it a simple matter to transfer the R.F. energy into the tuned inductance. The aluminium mounting brackets are non-magnetic.

The Aegis Signal Magnet is carefully packed in a special container. Full instructions and curves available in each carton.

Modernise your present portable or build a new one but be sure to use the AEGIS SIGNAL MAGNET (Loop Stick)!

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- ★ N.S.W.: WATKIN-WYNNE Pty Ltd., 173 Pacific Highway, North Sydney.
- ★ QLD.: CHANDLERS Pty Ltd., Cnr. Albert & Charlotte Sts., Brisbane.
- ★ S.A.: GEORGE PROCTER, 49 Pirie St., Adelaide.
- ★ W.A.: A. J. WYLE Pty. Ltd., 1011 Hay St., Perth.

must also limit coverage on the broadcast band, which is the very place we need it.

To overcome all these objections means fitting trimmers and series capacitors to each separate coil which results, as we suggested earlier, in a good deal of complication.

Our advice is to build the set first in its original form and worry about fancy tuning systems later, if you want to.

There might be one important exception from this advice, namely for the constructor who wants the set purely for listening to the main amateur bands. The coil data has been arranged so that it is readily applicable to this purpose.

SMALLER CAPACITOR

For use only on the amateur bands, the first step is to replace the large tuning capacitor with a smaller type, possibly a .0001 mfd midget. This will greatly reduce the tuning range to begin with.

Then, by building a variable trimmer into each coil and wiring it in parallel with the grid winding, the coverage can be adjusted so that the high frequency end of each amateur band comes in with the tuning capacitor almost out of mesh.

To quote actual figures, the connection of a trimmer across coil 2 can shift its high frequency limit from the quoted 4.4 to 2.9 Mc. The amateur band limit of 3.8 Mc will obviously be encountered with the trimmer screwed partly in.

In just the same way, the high frequency limits using the third, fourth and fifth coils can be made to coincide with the limits of the 7, 14 and 28 Mc amateur bands.

Only in exceptional cases should any change be necessary to the number of turns on the grid winding. If such a change is necessary, remember that reducing the turns will shift the tuning range bodily toward the higher frequencies. Increasing the turns will shift it the other way.

We have devoted a good deal of space to the subject, but you can probably appreciate that it is fundamental to the design and operation of the set.

The primary windings in each case are typical but not necessarily optimum. If you are using a large aerial, the set may perform more smoothly with fewer primary turns or with the winding moved further away from the secondary.

PRIMARY COUPLING

It is a sign of too tight coupling and/or too many turns if stations tend to spread excessively or if there is any difficulty in obtaining the reaction effect at any point in a band.

In general, quite loose coupling will have to be used where you may be attempting to tune amateur stations with a resonant type of aerial. This would be an exception, however.

Using 6SH7 valves, you should have no difficulty in getting ample regeneration on all bands. In fact, we had to throw some of it away deliberately by bypassing the detector plate to earth with a .0001 mfd capacitor.

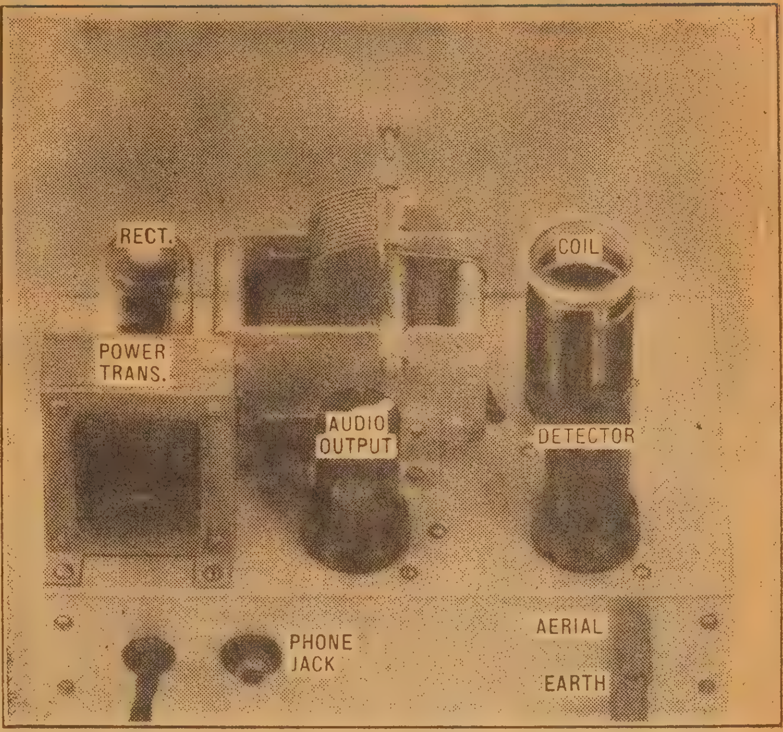
With a specially "hot" 6SH7 or a valve having a higher transconductance, it may be necessary to increase this value to ensure smooth regeneration on all bands. Alternatively, the reaction winding could be wound with fewer turns or moved away from the grid winding.

Contrariwise, valves having a lower transconductance may give more reliable regeneration with the plate bypass reduced in value or removed altogether. Only in rare cases should it be necessary to add more reaction turns.

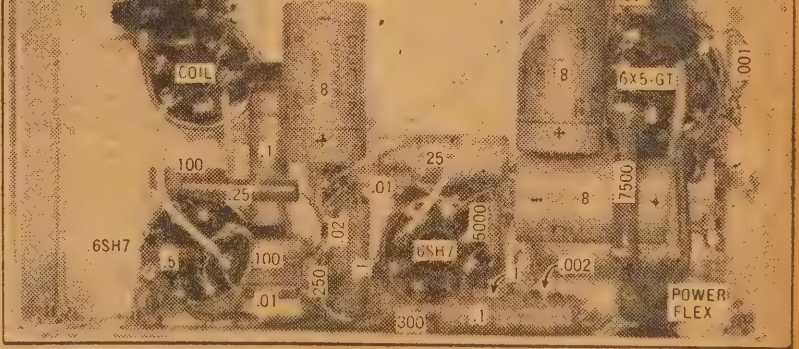
The big danger in so doing is tha the reaction winding may tend t "pull" the tuning, so that you fin yourself actually tuning stations wit the reaction capacitor. The result i only hopeless confusion.

In adjusting a reaction circuit, th objective is usually to have the se go into oscillation with the reactio capacitor somewhere around half i mesh, the exact position varying, o

TOP AND UNDERSIDE VIEWS OF SET



A rear view of the completed receiver. Note that the tuning capacitor has been mounted on its back with the aid of a couple of hand-made aluminium brackets. This kept the spindle to a convenient height in relation to the panel and also ensured a short lead from the fixed plates to the coil socket.



An underneath view of the set. A 5-position tag strip between the detector and amplifier sockets provides several handy anchor points. A 4-position tag strip is similarly used near the retifier socket.

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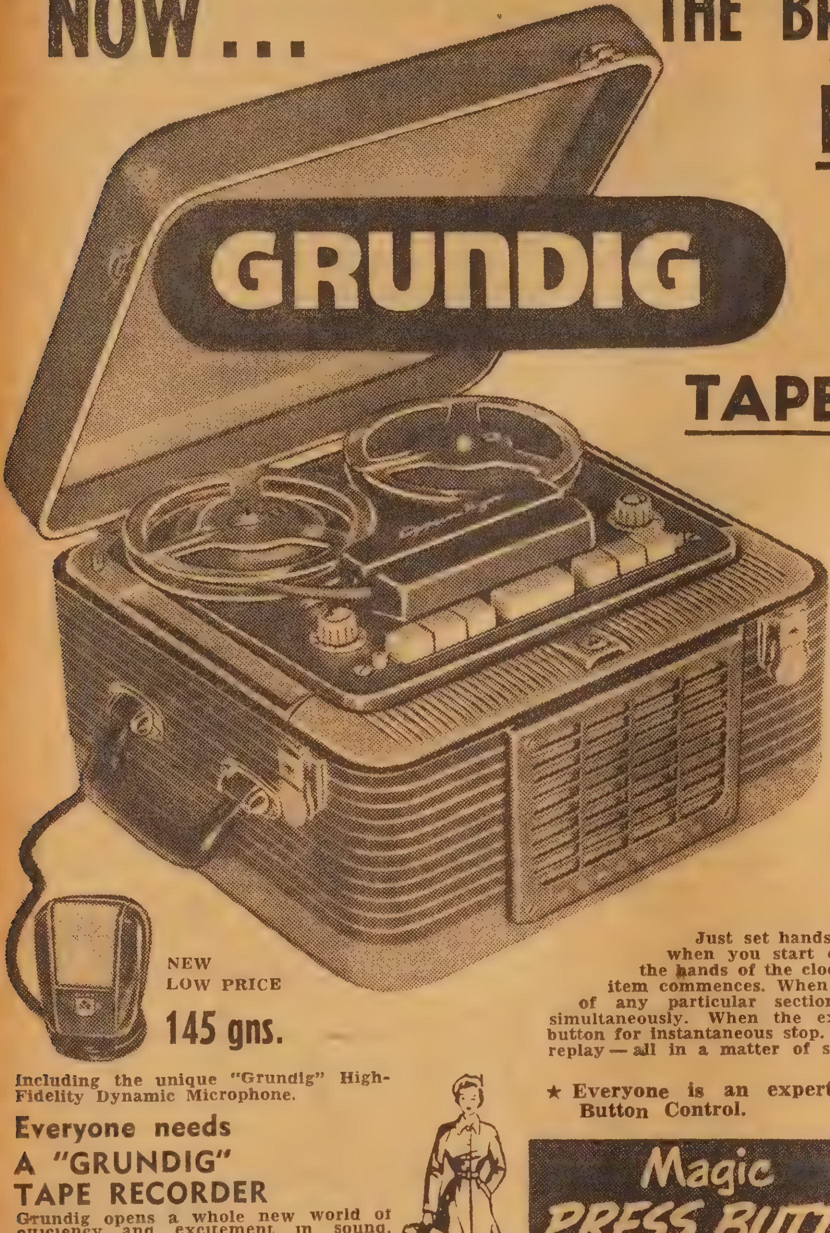
Grundig, the world's finest Tape Recorder



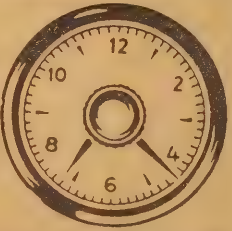
"Reporter TK9"

TAPE RECORDER

Presenting for the first time, the

CLOCK-CONTROLLED PLACE-FINDER

Picks the spot for Play Back, Re-recording or Erase anywhere in the whole 1½ hours of recording — with



SPLIT-SECOND ACCURACY.

Just set hands of the clock to the 12 o'clock position when you start each spool of the tape. As you record, the hands of the clock rotate. Make a note of the time each item commences. When you run back on fast wind for replay of any particular section, the clock hands rotate backwards simultaneously. When the exact time is reached in reverse, press button for instantaneous stop. Your chosen item is ready for accurate replay — all in a matter of seconds!

NEW LOW PRICE

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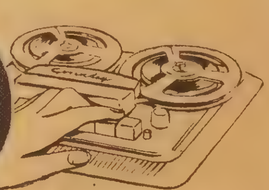
Grundig is light, and attractively covered.

Magic PRESS BUTTON CONTROL



No knob-twisting, no confusion. Every major control—Record, Play Back, Fast Wind (right to left), Fast Wind (left to right), Stop, Track Change, Temporary Stop—all are operated by press buttons—all clearly marked. You become at once a brilliant sound engineer!

NO OTHER TAPE RECORDER GIVES ALL THESE NECESSARY FEATURES !

- AUTOMATIC STOP at end of tape. You can't accidentally run the tape off the spool. No tedious re-threading.
- TWIN TRACKS. 1½ hours of life-like speech or high-fidelity music, or both.
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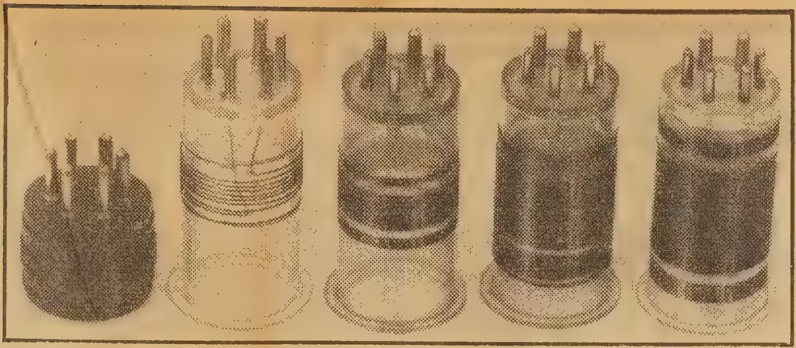

Here are the five coils we wound up for the receiver. The broadcast coil requires a full-sized former, likewise the next band. The other three coils could be wound on discarded valve bases. Winding data is given below.

course, from band to band and with different settings of the tuning control.

The reaction winding can afford to have about half the number of turns on the grid winding but no more.

In other respects, the circuitry around the detector is fairly standard. You will note that we have used a 0.5 meg. grid resistor, which is a good general value for valves like the 6SH7. With higher gain types, the value may have to be lower if they tend to "squegg" immediately after going into oscillation.

The volume control between the two stages is a very necessary part of the design. While the reaction control also affects volume, it likewise controls selectvity. Therefore, when trying to sort out stations on the broadcast band, the right procedure is to keep the reaction control just below the point of regeneration—thereby achieving maximum selectivity—setting the volume control for the required volume.

COIL DATA

All coils are wound on 1¼ diameter plug-in formers or valve bases Though actual gauges are quoted, some latitude is possible particularly on the shortwave coils, where space is not so critical. All windings are wound in the same direction.

BROADCAST BAND

Grid winding: 100 turns 29 B&S close wound. Primary: 15 turns of 29 B&S, spaced ⅛in from earthed end of grid winding. Reaction: 40 turns 36 B&S spaced ⅛in from grid end.

BAND TWO (1.2 to 4.4 Mc).

Grid winding: 38 turns of 24 B&S enamel close wound Primary: 11 turns of 29 B&S enamel spaced ⅛in from earthed end. Reaction: 27 turns of 29 B&S enamel spaced ⅛in from grid end.

BAND THREE (2.35 to 8.7 Mc.)

Grid winding: 16 turns of 24 B&S enamel, spaced to occupy ½in Primary: 7 turns of 29 B&S enamel spaced ⅛in from earthed end. Reaction: 8 turns of 29 B&S enamel spaced ⅛in from grid end.

BAND FOUR (4.6 to 17.6 Mc.)

Grid winding: 8 turns of 24 B&S enamel, spaced to occupy ½in. Primary: 2 turns of 29 B&S enamel spaced ⅛in from earthed end. Reaction: 3 turns of 29 B&S enamel spaced ⅛in from grid end.

BAND FIVE (9 to 32 Mc.)

Grid winding: 3½ turns of 18 B&S (approx.) enamel, spaced to occupy ⅜in. Primary: 2 turns of 29 B&S enamel spaced ⅛in from earthed end. Reaction: 2 turns of 29 B&S gauge spaced ⅛in from grid end.

Coming to the output stage, we had to consider ways and means of operating either phones or speaker—perhaps both.

The idea of simply connecting one or other in the plate lead is not very satisfactory. In the first place phones aren't always capable of carrying 8-10 milliamps. Secondly, the insulation on phone cords and terminals is often poor and there is a risk of shock.

The main circuit, as shown, provides for the use of phones. You will want to use them, anyway, for short-wave listening.

To this end, the output plate is fed through a 5000-ohm resistor. Audio voltage developed across it is coupled through a 0.1 mfd. capacitor to the active side of the phone jack, the body of which can then be at earth potential. The 0.1 meg. resistor across the jack prevents loud clicks when the phones are plugged in.

If you want to use speaker or phones alternatively, we suggest you adopt the arrangement shown in the appended diagram.

The speaker transformer is mounted on the chassis and the primary wired permanently into circuit. It takes over the function of the 5000 ohm resistor when the set is used for phones.

SPEAKER RECEPTION

For speaker reception, the voice coil is simply connected to the secondary of the transformer, either by way of a jack or a couple of terminals provided for the purpose.

The set could, of course, be used with speaker only but you would then miss out on the countless weaker stations which are clearly heard on phones.

The power supply, as you can see, is a very simple affair using a small power transformer and an indirectly heated rectifier. A 6X5-GT, 6X4 or 6V4 would be obvious choices for this position.

For the filter system we suggest a couple of 8 mfd electrolytics and a 7500 ohm 1-watt resistor. This gives ample smoothing for the out-

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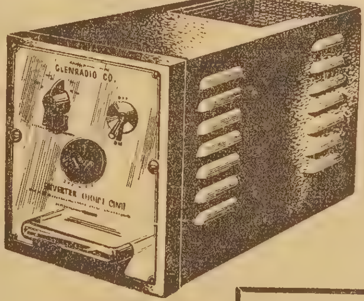

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Special models with different voltage input and output load manufactured on application.

Please add freight on all orders

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INPUT VOLTS D.C.	OUTPUT W AT 240V	PRICE RETAIL
12 32	100 watts) 50 100 watts) cycle	£29/17/6
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240	100 watts 50 cycle	£35/-/-

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Letter from AMERICA

to Mr. Briggs of

Wharfedale
WIRELESS WORKS LTD.

From . . . C.H.S.,
Palo Alto,
California,
U.S.A.

April, 1954.

Dear Mr. Briggs,

I do not often feel impelled by the purchase of a new product to write its manufacturer soon thereafter, offering an opinion. But after enjoying my new Super 12/CS/AL for a few weeks only, I cannot repress the thanks I have many times felt for the superb quality designed and built into your product.

I listened, in fact, to virtually every 12 and 15 inch speaker made over here; though, since A-B test facilities are very limited out this way, had to make most of my comparisons, between concerts, with what I could recall of "live" symphony performances, and their instruments. For less than double a Super-12's cost, I could find no one whose accuracy of reproduction, and freedom from distortion, appeared fairly comparable with the Wharfedale.

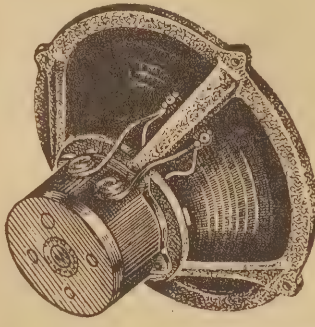
Because I am interested in reasons behind such performance, your little book, and articles in "High Fidelity", were of considerably more help than contributions from any other source.

I have learned that your production, from choice, is somewhat more limited. Which explains, in great part, why it took me over eight months of searching, through the Los Angeles and San Francisco areas, and by mail, to find a Super-12. I am very glad that I waited.

The only possible criticism that I could offer — tempered by realisation that there are other markets than America — stems from the English standard for bolt-hole locations. I was unprepared for this, had to remodel my enclosure to get the speaker in. But again, it was well worth it.

My thanks and warm congratulations to you, Sir, and your associates, for taking time to do a job so well.

Sincerely yours,
C.H.S.



The Super 12"/CS/AL Speaker, illustrated above, is fitted with aluminium voice coil, special cone with bakelised apex, and radial corrugations, plus the undoubted advantage of cloth suspension. This assembly, with the extremely high flux density, results in excellent transient response and sensitivity with a very wide frequency range. Since the introduction of this model some three years ago, the world-wide demand has always exceeded the supply.

Stock position is slowly improving.

Specifications: Alcomax III Magnet; Flux density 17,000 lines on 1¾" centre pole; Total Flux 190,000 lines.

Price £41/4/8 retail.

We also recommend the following models:

Super 5"
A highly efficient Treble Unit, fitted with small bakelised cone and aluminium dome, with response well maintained from 3,000 to 20,000 c/s. (Price £12/14/- retail.)

Super 8" CS
For refined quality up to 4 watts, or for use as Middle or Treble Speaker with cross-over network (Price £12/14/- retail.)

Super 8" CS/AL
An outstanding Treble Unit with aluminium speech coil and response maintained up to 20,000 c/s. This model is recommended for use in twin-speaker systems. (Price £12/2/10 retail.)

Wharfedale 10" CSB
After the Super 12"/CS/AL the 10"/CSB, fitted with wide-response cone and aluminium dome, is the best single speaker in the Wharfedale range. (Price £23/10/6 retail.)

Wharfedale 12"/CS
The 12"/CS makes a very good bass unit with suitable reflex loading and a cross-over between 400 and 3,000 c/s, and is the "next best" to the Wharfedale 15"/CS. (Price £24/19/- retail.)

Wharfedale 15"/CS
Now generally recognised as the best low frequency unit so far produced in England or any other country! This speaker is designed for smooth response between 25 and 2,000 c/s, with heavy cone and long speech coil. It is the ideal speaker for cross-over networks. When provided with 8 or 9 cubic feet of air loading the cone resonance is below 25 c/s. (Price £41/4/8 retail.)

The cloth suspension, employed in all Wharfedale Speakers mentioned above, lowers the bass resonance and gives a very smooth "top".

For All Further Information, we suggest you contact your Dealer.

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STOCK POSITION

Owing to the increasing demand for Wharfedale speakers both on the local market and overseas, **particularly in U.S.A.**, your dealer may not be able to give you immediate delivery of certain models. A few weeks' waiting time will be well rewarded when you enjoy the **absolutely Natural reproduction** of Wharfedale speakers, but we suggest you place your order now.

put stage and a supply voltage just a little short of 150. If you want a little more power for speaker operation, the resistor can be cut down to 5000 ohms without embarrassing the 6SH7's.

Other valves would have to be treated on their merits in this respect.

On the constructional side, we have not attempted to adopt the "put-this-lug-here" approach, because the details of each set will differ with the parts you choose.

There are a few points, however, which need to be watched.

The first and most important one is to keep the whole construction very rigid. This applies to the basic metalwork and to the mounting of all components. Only by taking this precaution will you finish up with a set which will operate smoothly and maintain its calibration.

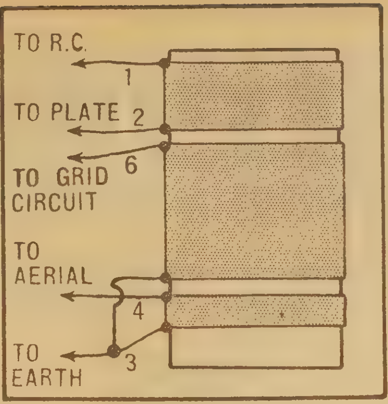
TYPICAL SIZES

The chassis and panel sizes, as quoted in the parts list, are convenient for the parts we used. They will probably suit most other components as well but it is wise to make sure.

Before you buy any chassis or cut any aluminium, lay out the parts you propose to use and see that everything can be fitted in.

In checking over the layout, try to keep the coil socket, the detector valve, the reaction control and the tuning capacitor fixed plates in a compact group. Long leads in this portion of the set are undesirable anyway but will prejudice also coverage of the 28 Mc amateur band, if you happen to be interested in it.

When locating the tuning capacitor, remember that its spindle should fall at a convenient height on the front panel. It is very easy to spoil the whole appearance of a set by having the dial too high or too low on the panel.



This diagram shows the order in which connections are made to the respective coils, all windings being in the same direction. The numbers correspond to pin numbers you could conveniently adopt if using 6-pin plug-in formers.

We took precautions against this by sketching the panel full size and locating the knobs on it, just as they would fall.

To satisfy all the requirements, we found it desirable to mount the tuning capacitor on its back, as seen in the photograph. The only alternative would have been to change over the whole layout of the set and have the reaction control on the right of the tuning knob—a rather awkward position.

Mounting the gang on its back may mean making a couple of small brackets but this is no great hardship for most enthusiasts.

Before you mount the tuning and reaction capacitors, check them over and make sure that their operation is completely smooth. A little adjustment or a spot of oil may help in some cases.

The point behind this is that the tuning of weak shortwave stations can be very critical. The job is made infinitely harder if the two controls will only move in a series of jumps—as poor controls do!

To the same end, it is worthwhile going to some trouble to get a smooth vernier dial.

LOOK AROUND

Unfortunately, we can't suggest any obvious choice because front-of-panel vernier dials are few and far between. Before you go chasing a new one (and the money to pay for it) we suggest you worry any acquaintance who might have had some past interest in radio.

Front-of-panel vernier dials, like the one we used, were once standard items on every set. Some of them were very good.

You will have to work out how to fit them and will need, in some cases, a reduction spindle to connect the 3-8in shaft of the tuning capacitor to the ¼in socket in the dial.

Ideally, the shaft should pass through the front metal panel, either with plenty of clearance or through an insulated bush. As many older

(Continued on Page 113)

Introducing TO AUSTRALIA:

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Pick-up with Interchangeable Heads!

SPECIFICATIONS:

Frequency Response: Total variation plus or minus 1 db 20,000 c/s to 40 c/s incl. transformer.
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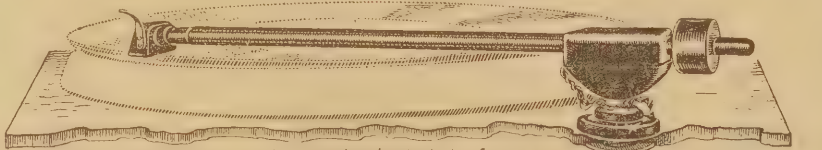
Generating System: Dynamic (moving-coil). Coil impedance app. 6 ohms, 1,000 c/s.

Playing Weights: Between 2 and 3 grammes for LP. Between 5 and 6 grammes for 78. Automatically adjusted by the weight of the head.

Stylus Material: Diamond only. Stylus sizes: 0.001" radius plus nothing minus 0.0001" 0.0025" radius plus or minus 0.0001".
Record and Stylus wear: These are lower than on any pickup of which we have cognisance.
Output: The shielded step-up transformer delivers an output of 11mV for each cm/sec. rms recorded velocity. This means that an amplifier with a sensitivity of 40mV at 1,000 c/s will be easily loaded by the pickup from commercial records.

The Arm: This is of advanced design having very low inertia. Friction is kept to a minimum by using a single pivot bearing. The arm is counterweighted and has provision for plug-in interchangeable heads. An arm rest is provided.
Dimensions: From the centre of the fixing stem to the front of the pickup head, 9¼". From the centre of the fixing stem to the rear or the arm, 2". The height of the pickup is adjustable and it can be used with any turntable.



The motor-board has been cut away to show the simplicity of mounting.

PRICES
The arm: £5/19/8 (retail). LP head with diamond stylus: £12/10/3 (retail). 78 head with diamond stylus: £12/10/3 (retail). Mumetal - cased transformer: £3/18/8 (retail).

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200 ohm	7/6
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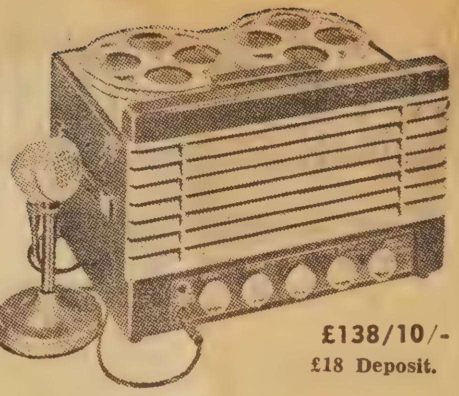

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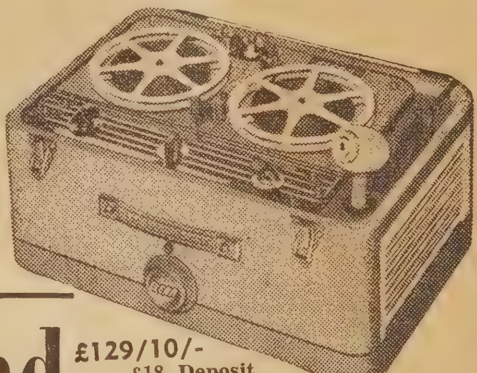

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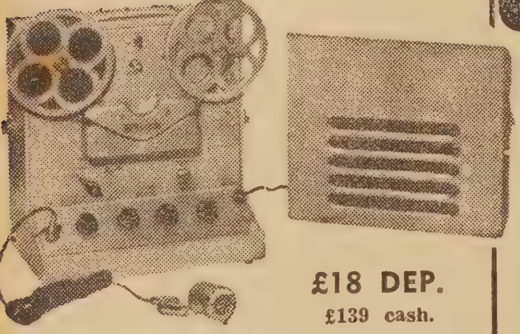

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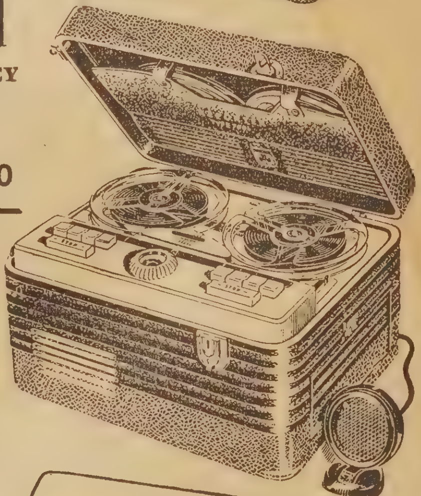

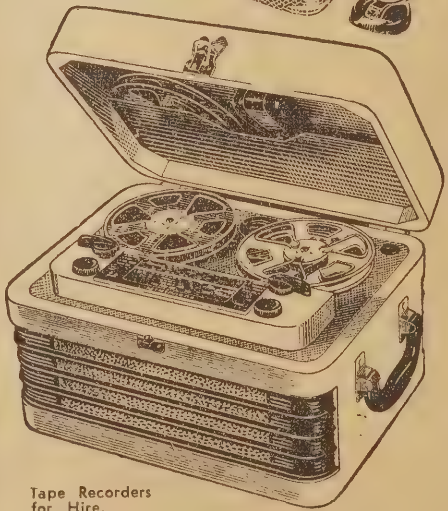

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FROM THE SERVICEMAN WHO TELLS

By way of a change, this month, I propose to begin my contribution with a rather pointed question to my fellow servicemen: Are your repairs to a receiver consistent with its original quality and finish, or do they impart to it that all-too-familiar junk-heap appearance?

I AM well aware, of course, that the same kind of question can be put to any tradesman who undertakes service and repair work, whether he be a carpenter, bricklayer, electrician, mechanic or anything else.

A conscientous tradesman will do his best to protect the client's interest, giving good quality work and drawing attention, if need be, to other work which needs to be done. The slovenly type, on the other hand, is more interested in collecting payment and giving for it as little work and attention as possible.

Only a supreme optimist could believe that there aren't such types in the radio trade.

The set which prompted these remarks was a typical 5-valve console, which was lugged rather unceremoniously into the service shop with the request that I "make it go again—if you can".

OLDTIMER

I soon gathered that the set in question had been borrowed from a relative, who had themselves bought it second hand from a radio service shop—not a very distant one either! It was clearly regarded by them as "a bomb" in the most modern sense of the term.

When I ultimately got around to doing the set, I had first to clear away the dust and greasy fluff that had collected on it over many years. It looked as though it had never been out of the cabinet since new, but a glance underneath soon dispelled any such ideas.

It had suffered a lot of internal probing and its works were festooned with replacement parts.

I might easily have blamed this on to a tampering owner, were it not for the fact that tampering owners usually clean their sets. What's more, they don't scribble their names across IF transformer cans to keep track of the chassis.

Only servicemen do that who have run out of labels—or who never used them in the first place!

As I looked underneath the chassis on to the untidy display of replacement parts, I couldn't help feeling pretty disgusted. What was worse, I had to trace faults among those parts and the first one I touched broke clean away from its "soldered" joint.

"TIN" ELECTROLYTICS

The chassis had been fitted with two of the early can-type "dry" electrolytics and these had long since gone really dry. Following the usual practice, someone had cut the leads off short and replaced them in the circuit with two of the modern tubular equivalents. One was a 600-volt type, which at least was commendable in view of the 385-volt transformer.

But how those electros had been installed! The leads were neither clipped to length nor covered in spaghetti to prevent possible shorts. They had simply been twisted round and soldered to convenient points in the circuit, leaving the units to flop around of their own accord.

Replacement bypasses on the audio cathodes, plus a couple of tubulars in the front end had been similarly "installed".

Wiring and other small parts had been pushed ruthlessly out of place, apparently in an effort to trace some elusive fault.

COIL "MOUNTS"

To complete the picture, a couple of new coils had been installed at some stage in the set's history. Two 1 3-8in cans had been mounted in place of the originals, swinging by one lug only, because the old holes were too wide.

No wonder the set was a "bomb". Everything about it was ragged and insecure—the direct result of it having been "repaired" on various occasions.

If only the serviceman (or . . . men) had taken a little more pride in their work! They would have pushed the wiring about a little more discreetly and immediately pushed it back again. They would have mounted the replacement parts in a secure fashion and neatly — in keeping with the original wiring.

They would have mounted the new coils on adaptor plates and prevented the troubles that would certainly follow in the way of fractured joints.

And they certainly would not have sold it to a customer in this condition.

Since I do service work for a living and not as a charity, I could not hope to correct all the faults but merely resoldered some of the joints that were holding more by good luck than anything else.

SCREEN TROUBLE

When I finally switched the set on, there was a vague, rather uncertain hum from the speaker, which almost immediately lapsed into silence. Then the screen of the output valve began to glow a bright red and I knew immediately that the speaker transformer was open circuited.

What happens in such a case is that an open circuited transformer leaves the output valve without any plate voltage. All the electrons, therefore, flow to the screen, which still has B-plus applied, causing the screen current to rise far above normal.

The screen overheats to a bright cherry red, and, if it happens to contain occluded gas, may cause the valve to become "soft".

The same thing happens, in many sets, when the speaker plug is pulled out.

So that I could at least finish the chassis, I plugged in the test speaker and proceeded immediately to tune a station. At least I think it was a station!

I have never heard a more muffled sound emanate from any set. It took me about a minute flat to find out why. Some very "bright" person had wired a 0.1 mfd. tubular between the output plate and earth, presumably in place of an original .01 or .005.

Even a .01 is bad enough . . . but a 0.1! Nor was there any feedback to modify its effect. It was just plain treble murder.

By the time I had corrected that and installed another electro to minimise hum, the chassis was okay. A replacement output transformer fixed the speaker.

When the set's temporary owner reappeared, I could only explain the circumstances to him and suggest that the set need not be thrown out as "a bomb". The major components were apparently in order and, if he cared to let me treat it as a "spare time" job, I would do my best to restore the wiring to a satisfactory condition.

BETTER THAN EVER

I could see that he wasn't at all impressed with the idea of spending money on "that old set" but, when he met me a few days later in the street, he brightly volunteered that the set now sounded better than he'd ever heard it before.

I should think it would, too, with the 0.1 bypass taken off the plate!

By way of reader's comment this month I have a letter which was originally addressed to the Technical Editor but which he has passed on to me for possible comment. It comes from Mr. A.K.G., of Dee Why, NSW, and concerns a defective electrical installation and some rather puzzling symptoms which he would like to have explained.

It seems that Mr. A.K.G. recently visited relatives in the country, whose house had just been connected to the power mains. He was rather shocked (no pun intended) to find that various objects about the place appeared to be "alive", one being a tank which by all accounts was completely insulated from everything and another the "earth" wire used to earth the entire system.

EARTH WIRE SHOCKS

So certain was our friend that one could not get a shock from an earth wire, which was obviously well and truly earthed, that he touched the bare earth wire while stan

STOP NOISE IN YOUR SET

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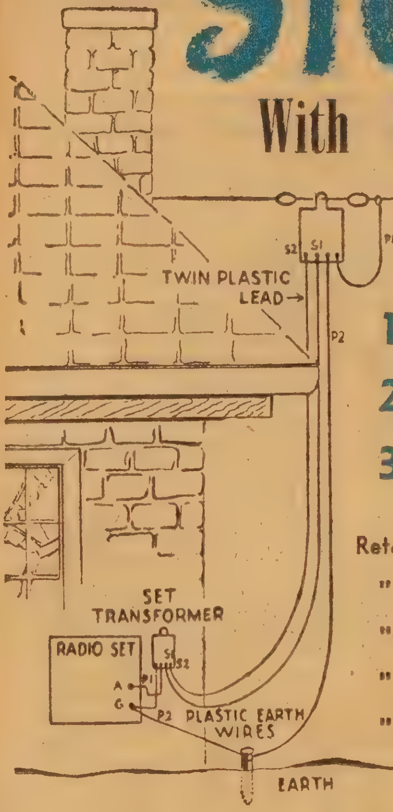
S2
S1
P1
TWIN PLASTIC LEAD
P2
SET TRANSFORMER
RADIO SET
S1
S2
A
P1
G
P2
PLASTIC EARTH WIRES
EARTH

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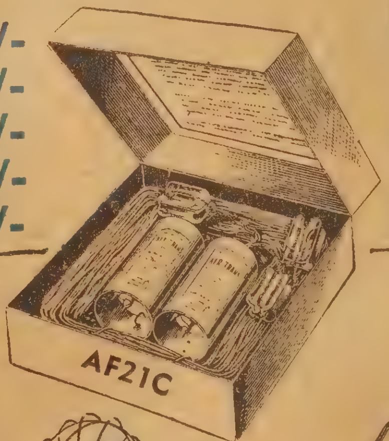

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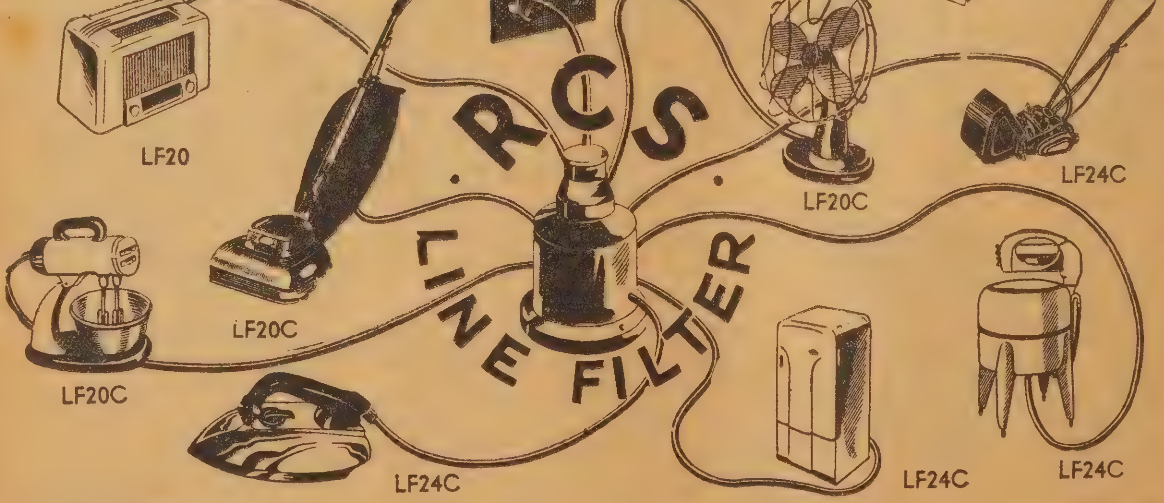
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LF20C
LF24C
LF20C
LF20C
LF24C
LF24C
LF24C

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ing in wet grass with bare feet. It seems that the only thing which saved him from serious injury was the very wise habit he has developed of touching any suspected wire with the back of his hand.

Thus it was that the violent muscular reaction, which followed, merely threw him clear of the wire rather than causing him to grasp it, and he received nothing more than a severe shaking.

The supply authorities subsequently discovered that the active side of the service had been connected to earth (doubtless someone was hauled over the coals for that!) and all the unpleasant symptoms vanished when the connections were reversed.

BUT HOW?

At this point Mr. A.K.G. naturally asks a number of questions as to how some of the observed effects could happen, since they appear to contradict the generally accepted rules. He asks:

"(1) The reason for a potential difference between a galvanised picket driven deep into the ground and a spot on the surface only a foot or so away."

"(2) The reason for the difference between earth and a tank 50ft away from the earth system, insulated by dry timber from any possible contact with any part of the electrical system."

"(3) As the resistance of these earth systems is only supposed to be a few ohms, ought not the loading of this incorrect earth have produced some embarrassment at the sub-station?"

"(4) Does not the failure of the earth in these circumstances cast a doubt on the value of any earth system?"

Now I'm not an electrician and I don't profess to know all the finer points of practical electrical installation but it does seem likely that a reasonable explanation can be given for the apparent contradiction in the effects noted.

The answer to question (1) revolves around the fallacy (and a lot of people make this mistake) that an earth connection is automatically of very low resistance. This is probably due to scraps of published information about the resistance between various points on the earth's surface.

I remember reading somewhere recently that local PMG technicians had measured the resistance of the earth between Sydney and Melbourne and found that it was some very low value like the square root of three-fifths of five-eighths of not very much—if you know what I mean.

But—and this is the catch—this low value is due simply to the enormous cross sectional area of the conductor and not to any naturally low resistance of the earth. In fact, the conductivity of the earth is very poor compared with ordinary conductors and it would be quite useless as a conductor if its cross sectional area was no greater than that of ordinary wire.

Of equal or greater importance is the fact that it is very difficult to make a really effective connection to the earth and this point will always introduce considerable resistance into the circuit.

A pipe, or even several pipes, driven into the ground makes contact with only a very limited amount of mother earth. If the ground happens to be dry, its resistance to the flow of current may be quite high and, unless we can arrange to keep the earth return always damp, we have to face the problem of an "earth" that is only just an earth!

This provides the answer to question (1), the resistance between the earth wire and the actual earth being high relative to the internal resistance of the supply source, so that the latter had no difficulty in maintaining something like the normal 240 volts across it.

Assuming a resistance of 12 ohms, the current being wasted would be 20 amps which, while high from a consumer's point of view, would not cause any immediate comment or suspicion at the supply point. Of course, there would have to be a reckoning sooner or later when the amount of bulk power purchased refused to tally with that sold to consumers.

We may take it then that the earth wire was something like 240 volts above earth, the connection to earth notwithstanding! Hence the "belt" when our friend went probing.

The problem of the live tank is not so easy to explain and must involve a certain amount of conjecture. I suspect that it was connected to the roof by means of the down pipe and that the roof was connected, accidentally, to the earthed side of the system. If so, the roof and all associated drain pipes would also have been alive but it may not have been easy to make contact with these except via the tank.

I think question (3) has been answered along with question (1)

Question (4) is a very interesting one and this also hinges on the point made in answer to question (1), namely, that it can be extremely difficult to make a good connection to the earth. This is particularly so where there is no reticulated water supply and the multiple earth pickets described by our friend were no doubt demanded by the local authorities as a means of minimising this trouble.

The requirements of various authorities vary considerably in this regard, some being very strict in their specifications. A case which came to my notice recently emphasised this and is worth repeating.

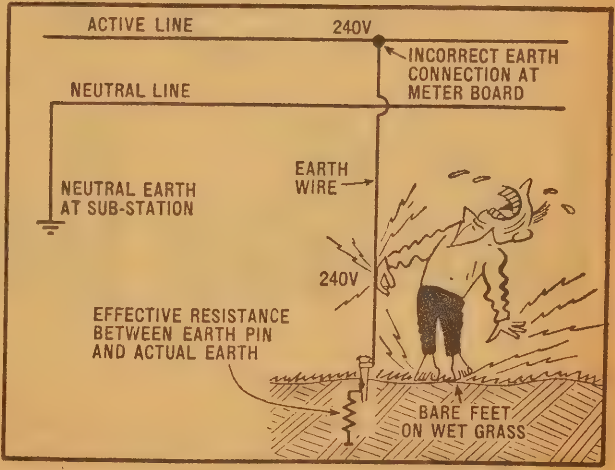
EARTH SYSTEM

This was also in a semi-rural area where there was no water supply and the earth system consisted of a number of spikes driven into the ground at regular intervals. However, before the local authorities would pass the system they demanded that, when the active line was connected to earth it would pass enough current to blow a fuse of prescribed size (15 amps if I remember correctly).

The snag was that the earth connection would not pass this amount of current and the electrical contractor was in real strife trying to provide a good enough earth to satisfy these requirements. Unfortunately I was unable to follow the story to its conclusion, but the case does illustrate that the problem of a good earth connection has been recognised.

While on the subject of electrical installations and earth systems there is another interesting story which was more or less a personal experience.

The trouble occurred during some renovations to a local cottage and, although I was not present from the beginning, I managed to piece the story together afterwards. One of the jobs to be done was to supply a new underground water service from the main to the house and the plumbers duly dug a trench around the existing service, laid the new pipes alongside the old ones, and prepared for a quick change over—the house being occupied at the time.


ACTIVE LINE
240V
INCORRECT EARTH CONNECTION AT METER BOARD
NEUTRAL LINE
EARTH WIRE
NEUTRAL EARTH AT SUB-STATION
240V
EFFECTIVE RESISTANCE BETWEEN EARTH PIN AND ACTUAL EARTH
BARE FEET ON WET GRASS

The old pipe was disconnected from the house system at a point just below where the pipe entered the house and nothing abnormal was noticed when this was done. But a few moments later, one of the plumbers placed his hand on the house pipe and received a terrific "belt". It was only the fact that the pipe was hard against the wall that prevented him grasping it involuntarily with possible serious consequences.

It so happened that I was installing a set only a few doors down the road and the plumber, whom I knew, asked me to see if I could locate the trouble or at least advise himself and the occupants how to avoid being electrocuted until the power authorities could be called.

The first clue was the fact that the lady of the house had apparently switched on an electric jug between the time the plumbers disconnected their pipe and the plumber received the shock. The housewife was quite sure of her facts because she had just realised that the jug was not working when the plumber gave out a wail that he had been bitten.

(Continued on Page 113)

Let's Buy An Argument

Any ideas I might have had about opening up a new subject this month have been thwarted by the need to answer some follow-up mail on matters referred to in the August issue. For example, our friend A.G.M. has more to say about transformer loading problems and his questions raise a couple of rather interesting side issues.

by Neville Williams

FIRST of all, we had better read what A.G.M. has to say:

Dear Sir,

I see that my letter has been rescued from the W.P.B. and used in the Let's Buy An Argument column.

Well, here is some more fuel for the fire:

In the discussion arising out of the diagram which accompanied the above point, I contended that if two independent loads were connected to the two 500-ohm secondaries at the same time, the individual impedance of those loads would need to be 1000 ohms each, and I ran into some opposition.

AN EXAMPLE

The same thing would apply when operating a tweeter and a woofer combination. Allowing that it was desired to feed both voice coils with the same voltage per frequency and leaving out the frequency discrimination networks required, I hold that it would make no difference whether they were connected in series as in figure 1, individually as in figure 2, or in parallel as in figure 3. However, I did not have it all my own way and the dust hasn't settled yet.—Yours faithfully, A.G.M.

First let me suggest, quite seriously, that A.G.M.'s letter never looked like going into the wastepaper basket, because it raised a very interesting and controversial point. Its appearance in print was certainly delayed by the pressure of other topics but that's all.

His second letter was something of a surprise, however, because I could find little coherence between the statements in it and the contents of the first letter, as already published.

Unless I am much mistaken, the whole tenor of his first letter was to establish an apparent anomaly involving two identical windings on an output transformer.

I pointed out that the anomaly cited by A.G.M. did not, in fact, exist and merely resulted from his having overlooked the basic fact that impedance relationships vary as the SQUARE of the turns ratio.

Once having recognised this fact, the basis of his observations was seen to be in error.

However, there's not much point in arguing on the "I-said . . . no-but-you-said" basis, especially when successive retorts have to be published at monthly intervals.

I can imagine nothing more futile, unless it be playing a game of chess by post!

ON ITS MERITS

I think we had best let the August issue stand as it is and proceed to treat this present letter on its merits. As I said at the beginning, it raises some points which are often not appreciated.

First, let's look at A.G.M.'s diagrams, which have been drawn exactly as he has shown them in his letter.

If taken on their face value, they suggest that there are two 15-ohm loads permanently in circuit, but connected in various ways to two separate windings, each nominally wound for a 7½ ohm load.

I have good reason for carefully phrasing the above statement, because multiple secondary windings can be used in a variety of ways—not always those intended by the designer!

For example, the output transformer in a public address system may well have two entirely separate secondary windings, to cope with different requirements in service. One may be a tapped 500-ohm winding for use with medium impedance lines and the other a tapped winding of much lower impedance for feeding voice coil circuits directly.

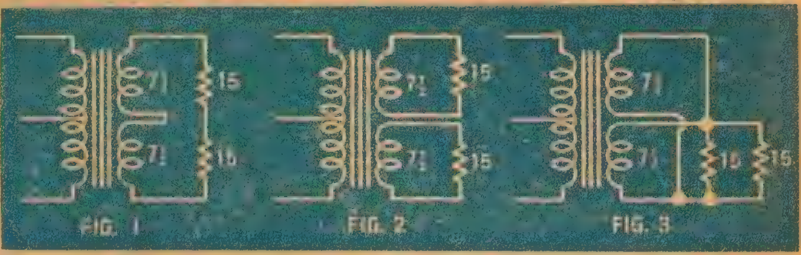
ONE AT A TIME

It would be logical in such a case to mark the output terminals on the assumption that only one winding would be in use at a time.

Thus, four 500-ohm speakers in parallel would reflect optimum load for the output plates when connected to the "125-ohm" tapping on the higher impedance winding.

Conversely, the same optimum loading might be obtained by oper-

MORE ON OUTPUT TRANSFORMERS



A correspondent suggests that all three of these connections present the same reflected load across the primary. In point of fact they do, but the diagrams do not correspond with circuit conditions when operating a "woofer-tweeter" speaker combination.

ating a number of voice coils in parallel from an appropriate tapping on the low impedance winding.

If it were necessary to operate both medium and low impedance systems simultaneously, each network would be tapped across fewer turns than normal to present something like the correct total load to the output valves.

One might well run off at a tangent here and start discussing whether loading is as critical as all that, but I don't propose to get mixed up with that at the moment. It is sufficient to emphasise that amplifiers and transformers do exist with multiple output windings which are intended to be used ONE AT A TIME.

But, taken at their face value, the sketches submitted by A.G.M. assume that the windings are used and loaded SIMULTANEOUSLY.

On this limited basis, I can tell you at once that A.G.M.'s statements are quite correct.

Since this may not be self-evident, however, it may be worth while to see how the three cases work out.

TYPICAL FIGURE

We might assume, for example, that the transformer has a turns ratio, total primary to single secondary of 40:1. I choose this figure merely to make the calculations easy.

In figure 1, the two secondaries are connected in series, so that the turns ratio, total primary to total secondary, is only 20:1. The impedance ratio will be equal to the square of this, or 400:1.

Now we find that the total load connected across the secondary is 30 ohms, so that the load reflected by the primary is equal to 30 x 400, or 12,000 ohms. Remember this figure.

Now, take diagram 2. Here the turns ratio, primary to top secondary, is 40:1, giving an impedance ratio of 1600:1. This is coupled to a 15-ohm load, which reflects into the primary as a load of 15 x 1600 equals 24,000 ohms.

Precisely, the same figure is reflected into the primary by the lower secondary so that the total load presented to the output valves is 24,000 ohms in parallel with another 24,000 ohms or a total of 12,000 ohms—as before.

Figure 3 introduces the case where two secondaries are connected in parallel and the effective turns ratio is the same as if only one secondary were used. The extra secondary does not markedly affect the voltage delivered to the load, nor the wattage dissipated in it, the only difference it makes being a slight reduction in coupling losses.

Thus we are left with an effective turns ratio of 40:1 and an impedance ratio of 1600:1. The two 15-ohm loads in parallel represent 7½ ohms and this, multiplied by 1600, produces once again a reflected primary load of 12,000 ohms.

Thus far, A.G.M. is perfectly correct, but, in practice, his diagrams do NOT represent the conditions which apply when feeding a woofer and tweeter speaker combination, as mentioned in his letter.

What many people fail to realise is that such speakers do not (or should not) present a simultaneous load to the output valves, except perhaps in the crossover region.

The whole basis of their operation is that power should be delivered at the low frequencies only to the woofer; at high frequencies only to the tweeter. Thus, over most of the range, the load on the amplifier is determined by only ONE speaker at a time, the other one being shorted or disconnected according to the operation of the frequency dividing network.

NEW APPROACH

In the face of this new (but practical) condition it is clearly necessary to revise the relationships suggested by our correspondent.

Take figure 1, for example.

Since the voice coils are considered to be in series, one must assume that the frequency dividing network will effectively short one of them over portions of the range, leaving the other to present the active load of (nominally) 15 ohms.

In the crossover region, both will be partially shunted and their net series impedance (supposedly) remains somewhere near 15 ohms.

Thus the transformer should simply be designed to operate into 15 ohms, just as if it were for a single speaker of that nominal value. If it had two secondaries intended for series connection, each would be rated at 3¾ ohms, not 7½, as might be inferred from figure 1.

If the speakers were fed from separate secondaries, as suggested by figure 2, then the nominal impedance of each winding would have to be pushed up to 15 ohms. At the respective ends of the range, one speaker or the other must be presumed to be out of circuit, leaving the other to present the sole load for the amplifier.

A DIFFERENT STORY

You see how drastically the picture changes, when we consider the true state of affairs.

In figure 3, the two secondary windings would again have to be wound for 15 ohms, a value that would not be affected by connecting them in parallel.

But here again, the voice coils could not rightly be represented by two 15-ohm resistors in parallel across the line. They might effectively be in series or in shunt at the end of the dividing network but one thing is certain, they would not (or should not) be fully in circuit at the one time.

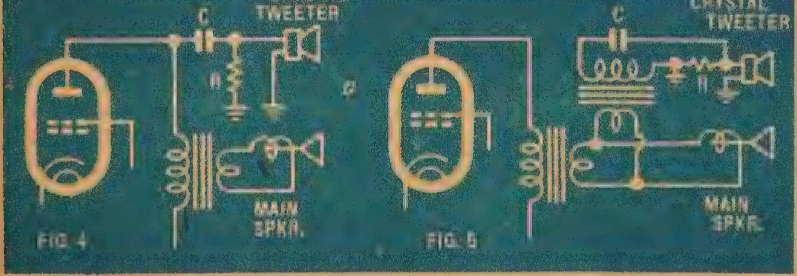
The load would simply remain at a nominal 15 ohms.

We may, therefore, conclude, if such is necessary, that although A.G.M.'s diagrams are quite correct in themselves, they cannot be considered to represent the matching requirements for a woofer and tweeter pair.

In point of fact, they relate to the very opposite set of conditions and yield an answer which is in error by a factor of 2:1.

That looks like a major tragedy, of course, and mathematically it might be. In practice it mightn't mean so much, when balanced against the vagaries in impedance of any ordinary speaker voice coil. That is why I referred so frequently in the foregoing remarks to "nominal" impedance.

As I've said before, there's a Gilbertian touch about the many and solemn decisions on matching, made in the full knowledge that



Here is yet another speaker matching problem submitted by a reader. Does the connection of a crystal tweeter upset the load on an output valve?

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While on the subject of loudspeaker matching, it may be interesting to mention a letter from a reader in Kew, Victoria, with a rather similar problem.

This reader has acquired a high frequency crystal "tweeter", and is worried about its connection to an existing receiver. He wants to know what impedance it would have and whether it could be operated from a transformer stepping back up from voice coil impedance to a higher value.

Furthermore, if he did this, would not the 12 ohm primary of the second transformer be in parallel with the 12 ohm voice coil and result in a net 6 ohm load, whether or not the tweeter was in circuit?

Logically, the first step is to make some observation on the speaker's impedance—and I'm afraid it can only be "an observation".

LIKE A CAPACITOR

A crystal tweeter is fundamentally a capacitor with a rather dubious power factor. Its impedance, therefore, tends to fall as frequency rises, being the exact opposite in this respect to a conventional voice coil.

However, like the voice coil, its very operation requires it to produce acoustic power, so that factors like air loading, coupling, resonance, &c., tend to superimpose themselves on its natural capacitive characteristic.

I'd be very surprised, therefore, if the manufacturers of a crystal tweeter could do more than quote its impedance at some given frequency and accept the fact that it will vary from this figure elsewhere in the range.

On this basis, I have heard figures quoted for crystal tweeters of between 5000 and 10,000 ohms, which does little more than justify the observation that they are "high impedance" devices and broadly suitable for operation directly from a plate circuit.

In actual fact, a crystal tweeter can be operated in the circuit arrangement shown in figure 4. The components C and R combine to prevent DC from reaching the speaker element, and also to filter out the lower frequency components.

TYPICAL VALUES

In a typical case, R may be about 20,000 ohms and C something less than .01 mfd. A lot depends, of course, on the characteristics of the tweeter and the range of frequencies over which it is intended to operate.

But what does it do to the load? Ostensibly, if one connects such a tweeter in parallel with an existing speaker system, the load on the output valve will be, roughly, halved. In point of fact this may not happen at all.

Above about 5000 cps, where a tweeter would logically start to come in, the load presented by an ordinary speaker would be some abnormally high value of voice coil impedance, stepped up by the transformer and probably shunted by a liberal helping of the transformer's own reactance.

The tweeter might, therefore, easily constitute the major component in the valve's total load and even bring the load more into line with what it should be. It's all so delightfully vague!

While figure 4 is readily applicable to an ordinary receiver, it doesn't lend itself quite so well to a push-pull circuit or, in fact, to any amplifier using a wide-range transformer, high overall gain, and, possibly, a high degree of negative feedback.

Such amplifiers are rather prone to oscillation if one starts hanging too much wire and too many components on to the output plates.

In the face of such a problem, the obvious answer is a circuit of the type shown in figure 5. It avoids the need for any direct connection to the plate circuit and allows the tweeter to feed, as it logically should, from the voice coil leads to the main speaker.

But what about this second transformer? What should be its general characteristics and particularly its impedance ratio?

Obviously, if it is to be shunted permanently across the voice coil line, its natural reactance must be high in relation to the nominal impedance of the line. It must, therefore, have virtually as much inductance as the main output transformer.

SMALL TYPE

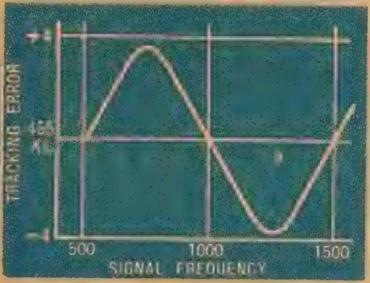
Fortunately, as it doesn't have to carry any direct current, a compact mu-metal job is feasible. If not of this special type, then it must be one of the more convenient variety, medium in size, of wide-range design and having the same order of voice coil impedance rating as the line from which it operates.

At the high frequency end, it must obviously be efficient, otherwise the tweeter will not receive its proper drive.

BEAT FREQUENCY OSCILLATORS

I think the problem on page 87 of the August R & H may be explained by considering the "tracking curve" of an average superhet receiver. The tracking curve (see diagram) is a graph of the error introduced by ganging the oscillator tuning with the others.

As a result of this error, the IF is NOT constant but is continuously varying over the band. In most cases it is 455Kc only at three places on the dial. Thus, if a station is tuned in and the B.F.O. set to the zero-beat condition, it is only zero beat to the particular IF associated with the position on the dial.



Any movement of the tuning condenser will cause this IF to change (see diagram) and this new IF will beat with the preset B.F.O. and give an audible note.

Before expanding the above notes, a brief re-statement of the superhet principle may not be out of place.

In this type, the incoming signal is mixed with a locally generated one and changed to a new frequency known as the intermediate frequency (IF). This IF is amplified in a high-gain fixed-frequency amplifier before detection.

For general work, the IF is 455Kc and is obtained by selecting from the mixer circuit the "difference" between the incoming signal and the locally generated one. For example, typical figures are: Wanted Signal — 1000Kc; IF — 455 Kc; Local oscillator — 1455Kc.

Thus the tuning requirements are: (a) tuning circuits to cover the desired station and (b) a local oscillator to follow (a) and keep the IF constant at 455 Kc.

This means that, for the tuning range 1600-500 Kc, a local oscillator range of 2055-955 Kc is required. The tuning range is 3.2:1 and the oscillator range 2.15:1. Tuning is accomplished by means of variable condensers and, in the interests of economy and simplicity, they are on the same shaft.

To achieve perfect tracking, it would be necessary to have a specially designed condenser for the oscillator section. This is not economically practical. It is possible, however, to compromise with an ordinary condenser by suitably designing the coils and fitting "padders" and "trimmers" to the circuit.

This results in a tracking error and is summarised by the "tracking curve", as shown. It will be seen, in this case, that the IF is 455Kc at three points only in the range. At intermediate points, there is up to 3.5Kc error.

This error is not serious, since the circuits are broad enough to accept it. The curve will vary, however, from receiver to receiver, both in the degree of error and in the number and the location of the 455Kc points.

Back to our problem:

Suppose we tune a station at 1000Kc and zero beat the B.F.O. Since we have picked a zero error point, the B.F.O. will be set at 455Kc. Movement of the tuning condenser in either direction will alter the IF value, resulting in an audible beat note. This effect will be apparent at any position of the tuning dial, provided the B.F.O. is set to zero beat each time.

(N.S. Surrey Hills, Melbourne.)

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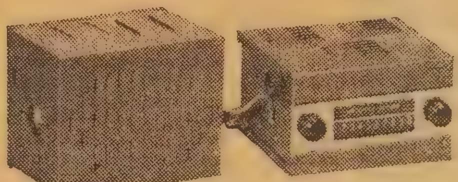

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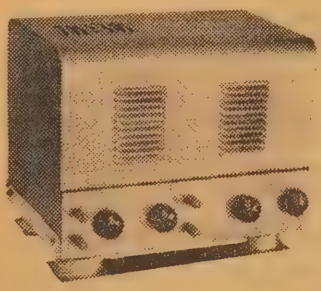

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Without the tweeter connected, a good transformer will not of itself load the voice coil circuit to any extent.

The fact that a transformer winding is rated at "12 ohms" does not mean that it constitutes a load of that value. Rather does it infer that the winding is suitable for use with a 12-ohm load, stepping down to it or up from it, as the case might be.

That being so, and provided he uses a reasonably good step-up transformer, our correspondent from Kew can forget any ideas of the transformer itself loading his voice coil circuit.

IMPEDANCE RATIO?

But what of its impedance ratio? I admit that it becomes a pretty hopeless problem if you have to approach it on the basis of stepping up a circuit that is only nominally 12 ohms to another that is only nominally several thousand ohms. That is bad enough, without also trying to arrange that all the varying impedances add up to a valve maker's figure for optimum load. In fact, I wouldn't even try.

From a practical viewpoint, the most urgent problem by far is to balance the acoustic output from the tweeter against that from the main speaker.

Unless the manufacturer can help in this regard, our correspondent had best borrow a couple of transformers with different ratios and choose the one which gives a suitable balance betwen treble and bass, forgetting the load problem altogether.

Fortunately, the signal amplitude at high audio frequencies is seldom very great in practice and load problems aren't as urgent as in the bass region.

There's a good deal of thought going into tweeters these days, and I tip that we'll be seeing more of them on the market in the not-too-distant future.

THE B.F.O. PROBLEM

From a reader in Melbourne comes some rather unexpected comment on the beat frequency oscillator problem, also mentioned in the August issue (page 87). We have had to trim the letter somewhat to conserve space but the writer's ideas are still quite clear. I suggest you read the letter before going any further.

Let me say, without equivocation, that the explanation put forward by N.S. is wrong, being an unusual confusion of ideas around the familiar superhet tracking curve. Thinking it over, however, I can quite see how the difficulty has arisen.

It boils down simply to a question of what determines the intermediate frequency in a superhet receiver. Is it equal to:

(1) The difference between the resonant frequencies of the signal and oscillator tuned circuits.

(2) The difference between the frequency of the wanted signal and that of the local oscillator.

(3) The frequency to which the IF channel has been peaked.

In an ideal receiver, all three would give the same answer. N.S., however, deliberately raises the question of what happens in the non-ideal set-up.

His letter depends entirely on proposition number 1—hence his introduction of the tracking curve.

There is so little to support this concept of intermediate frequency that I have already branded it as "wrong". In fact, it breaks down altogether in the case of a superhet receiver with an aperiodic aerial circuit. As we have just recently proved with our "Senior Signal Tracer", it is entirely possible to have a local station superhet with no aerial tuning at all!

But would N.S. contend that it therefore has no intermediate frequency?

If I had to do so, I would far sooner make a case for definition number 2.

In practice, I suggest number 3 is the logical one. But let's start at the beginning and see why I should say this:

EXPLANATION

The usual explanation of a superhet receiver runs along the lines that the incoming signal is first accepted by a circuit tuned to its own frequency. It then beats with the output from a tunable local oscillator to produce a fixed intermediate frequency, usually at about 455 kc.

As N.S. has pointed out, gang tuning of receiver is possible because of careful coil design and the use of a series "padder" capacitor, which keeps the oscillator higher in frequency than the signal circuits by an amount equal to the selected IF.

He also points out, quite correctly, that the "tracking" of the signal and oscillator tuned circuits is not entirely accurate. In the usual superhet, the difference between the signal and oscillator circuits is only equal to the IF at three points in the tuning range; elsewhere, there is a discrepancy of a few Kc, as indicated in the curve.

So far so good!

In following along these very conventional lines, however, we tend to overlook one seemingly elementary but very important point:

A person using a superhet receiver does not work out a lot of figures every time he wants to tune in a station. He merely turns the tuning knob until the wanted station is heard to best advantage. Of tracking error, oscillator frequency, resultant IF, &c., he remains blissfully unaware.

Under ideal conditions, the point he selects for best reception would normally occur with the signal frequency circuits tuned exactly to the wanted station frequency. The local oscillator would be exactly (let us say) 455 Kc above this figure, resulting in an IF of 455 Kc, resonant with the IF channel.

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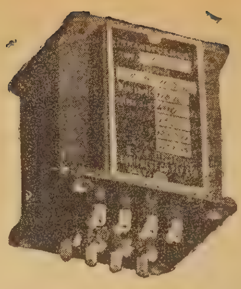

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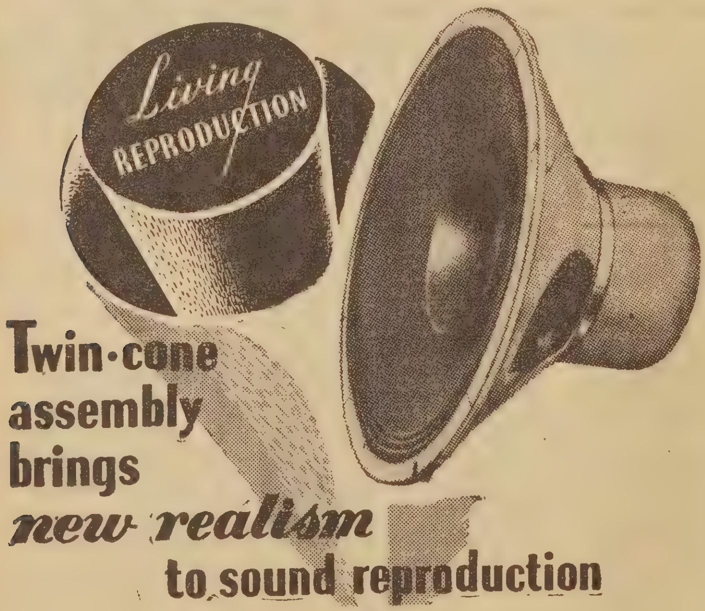

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way or the other, would reduce the response of the signal circuits to the wanted carrier; it would also affect the local oscillator and produce a resultant intermediate frequency displaced from the 455 Kc resonance peak of the IF channel.

The signal strength would suffer, and likewise the tonal balance.

But what happens in a receiver which is not in perfect alignment?

THE PROBLEM

When tuned for best reception, the wanted signal may not coincide in frequency with the signal tuned circuits and the intermediate frequency may not coincide exactly with the resonant point of the IF channel.

The person tuning the set merely —and automatically—selects a compromise position which gives the best reception of the wanted signal —figures notwithstanding.

Tuning the dial to one side of this compromise position may conceivably bring the signal circuits into resonance. However, it will also affect the oscillator and shift the intermediate frequency further away from the resonance point of the IF channel, thereby offsetting any advantage.

It simply boils down to a question of which group of circuits is most critical—the aerial (and possibly RF) tuning, or the IF channel.

Since the very nature of the problem imposes a compromise, it follows that the tuning position must favor the more critical or more selective circuits. In other words, it is more serious to be 3 Kc off resonance in a sharply tuned channel than in one which is much broader.

I.F. IS SHARPER

In an ordinary superhet, the IF channel is a great deal more selective than the signal frequency circuit (or circuits). This follows from the lower frequency of the IF channel, from the design of the transformers and the number of sharply-tuned circuits involved.

The signal frequency circuits provide useful discrimination against images and powerful local stations, but they contribute only a minor proportion of the effective interchannel selectivity.

Because of this, the action of tuning a superhet is largely one of bringing the resultant intermediate frequency into resonance with the IF channel.

The dial is primarily an oscillator frequency control which (very conveniently) also manages to keep the signal frequency circuits fairly close to resonance.

Where the signal circuits are exactly in step with the oscillator, gain and selectivity will be at a maximum. At points in the range where tracking is poor, gain will suffer to some extent, likewise the signal-to-noise ratio. However, tuning will not be greatly affected.

Having made these points, let's look at N.S.'s letter. For the most part, it is an excellent summary of things as they are in a superhet. Paragraph 2 is its weak point.

To all intents and purposes, the intermediate frequency of an ordinary superhet IS constant, for it is located by the "nose" of the relatively sharp IF response curve.

The natural procedure for anyone tuning such a set is to turn the dial until the heterodyne product of the oscillator and carrier sits squarely in the nose of this curve. They do this by observing such things as signal strength, tuning meter deflection, tonal balance and the change from carrier "swish" to carrier "swoosh", if you know what I mean!

But what about the tracking curve? Well, if the wanted station happens to be in a region of poor tracking (as in figure 6) then we must be prepared to find, on careful checking, that the signal frequency circuits are mistuned in respect to signal by some 3 or 4 Kc.

And this is precisely what happens. I have frequently aligned a receiver by the accepted techniques, then checked it for tracking error at other points on the band.

By tuning the set for maximum response on an output meter, the reading can subsequently be increased by touching up the aerial (and, possibly, RF) trimmers. If the tracking error has influenced the dial setting at all, it could only have been to a very minor degree.

Having made this point, the second part of paragraph 2 must also be in error, together with other dependant references.

Let's say that we tune a station which happens to occur at a point of zero tracking error, using a tuning indicator if you like. There can be no doubt that the resultant intermediate frequency will coincide with the "nose" of the IF selectivity curve, which we will assume to be centred on 455Kc.

EXACTLY 455 kc

If the BFO is now set to zero beat, it must also be exactly on 455Kc.

Now, let's say that we switch off the BFO without altering its setting and tune to a station in he region of maximum tracking error, again using the tuning meter.

The region of maximum signal strength will certainly not occur with the signal circuits at resonance and the intermediate frequency 3.6Kc above or below 455Kc.

Unless I miss my guess, the point of maximum response will occur with the conditions precisely reversed—the signal circuits almost 3.6Kc off resonance and the intermediate frequency very close indeed to the 455Kc resonance peak.

If now we switch on the BFO, we certainly will not hear a 3.6Kc beat note. At the most we may hear a low growl due to the fact that the badly tracked signal circuits have caused us to tune very slightly to one side of the oscilla-

(Continued on Page 112)

FOR PERFECT REPRODUCTION—

World Famous

M.S.P.

SPEAKERS

SIZE	TYPE	MAX POWER HANDLING ABILITY	FREQUENCY RESPONSE	VOICE COIL IMPEDANCE
3in	BC1-3P1	0.5 watts	205+35 c/s to 3.5 kc/s.	3.2 ohms
4in	BH2-4P2	3 watts	179+17 c/s to 7.5 kc/s.	3 ohms
5in	AC44-5P32	3 watts	110-160 c/s to 7.5 kc/s.	3 ohms
6in	AG46-6P44	4.5 watts	110+10 c/s to 5 kc/s.	3 ohms
7in	AY33-7P28	6 watts	130+12 c/s to 7.5 kc/s.	3 ohms
9in x 6in	BF6-96P3	5 watts	125+15 c/s to 7.5 kc/s.	3 ohms
12in	AU78-12P49	6 watts	65+10 c/s to 6.5 kc/s.	3 ohms
12in	AU61-12P40	15 watts	77+12 c/s to 6.5 kc/s.	6.5 ohms
12in	AU54-12P38	20 watts	57+12 c/s to 6.5 kc/s.	12.5 ohms

The above are Permanent Magnet Models LESS TRANSFORMER. Electro Magnetic Models are also available, 5in, 6½in, 7in and 12in sizes.

AVAILABLE AT THE QUEENSLAND AGENTS:—

CHANDLERS

Head Office and Wholesale Dept. Cnr.
ALBERT and CHARLOTTE STS.,
BRISBANE. FA0341.

Also at Cairns, Townsville, Mackay, Rockhampton, Bundaberg, Maryborough, Toowoomba, Warwick.

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AERIALS.

A full range of WALBAR car aerials is available. A type to suit every car:—

Windscreen types	from £2 1 2
Side Mounting types	from £2 9 8
Cowl Mounting types	from £3 14 9
Bumper Bar types	from £4 7 0
Roof types	from £5 0 11
R.C.S. Loop Aerial	10/-
Bramco Loop Aerial	9/9
Aegis Loop Aerial with loading coil	22/9
Aegis Ferroxcube Loop Stick	32/-
Bramco Ferroxcube Loop Stick	26/9
Plastic Indoor Aerial Wire. 24ft	1/9
Lead-ins. Flexible Window type	6d
Egg Insulators	6d
Captain Aerial Unit. Eliminates the outside aerial	7/9
Outside Aerial Wire. Insulated. 100ft	4/9

ALUMINIUM SHEET.

18 Gauge, medium hard. Polished.

6in x 6in	1/6	12in x 12in	6/-
6in x 8in	2/-	12in x 18in	9/-
8in x 12in	4/-	18in x 18in	13/9

AMPLIFIERS.

As well as supplying complete kits for amplifiers, we can supply them ready to use, or can build special models to order. The following are normally available from stock:—

"Playmaster" No. 6. A high grade push-pull 8-watt unit, with 12in Rola or Jensen Speaker	£31/5/-.
"Junior" 4-watt unit with 8in speaker	£16/10/-

BEZELS.

Jabel Miniature plastic	10d ea.
Tenatone ¾in Bezel	4/6 ea.
Tenatone ¾in with lamp holder	6/8 ea.
Tenatone 3/8in Bezel	3/9 ea.
Tenatone 3/8in with lamp holder	5/6 ea.

BOBBINS.

R.C.S. Bobbins are ideal for winding special coil, etc.

MO19 5/8in x ½in Square	10d
MO20 3/8in Hole 1in dia. 13/16in wide	1/4
MO21 3/8in Hole 1¼in dia. 13/16in wide	1/6
MO18 RF Choke Former	8d

BATTERIES.

A complete range of EVEREADY DRY BATTERIES is always available and are guaranteed fresh stock.

BAKELITE PANELS.

Polished black panel material.

8in x 4¼in x 1/16in	1/9
8in x 6in x 1/16in	2/-
12in x 8in x 1/8in	8/-

BATTERY CHARGERS.

S.T.C. 6 volt 4 amps	£9/15/-
S.T.C. 12 volt 3 amps	£10/10/-
S.T.C. 6 and 12 volt combined	£11/10/-

COIL FORMERS.

R.C.S.	1¼in 6 pin Plug-in	4/6
	1½in 6 pin Plug-in	5/-
	2¼in x 1¼in dia poly tube	2/-
	2¼in x 1½in dia poly tube	2/-
Jabel	2in x ¾in dia poly tube threaded 16 TPI	1/-
Brown Bakelite	¾in dia per ft	1/-
	2in dia per ft	6/-

BATTERY CLIPS.

Alligator	5d
10 Amp type	9d
25 Amp type	1/-
50 Amp type	1/6

CHOKES. Filter.

National:—		Ferguson:—	
12 H 50 mA	11/6	30 H 25 mA	28/9
14 H 60 mA	13/9	15 H 60 mA	22/5
30 H 60 mA	45/-	15 H 80 mA	37/9
15 H 80 mA	42/11	12 H 100 mA	38/2
30 H 80 mA	48/5	12 H 150 mA	53/11
15 H 100 mA	45/-	12 H 200 mA	65/6
15 H 125 mA	59/-		
15 H 150 mA	67/-		

R.C.S. 14 Henry, 60 mA	10/6
Bramco 12 Henry 50 mA Midget	10/6
Ferguson, 2 Amp L.T. Vibrator Choke	19/8
R.C.S. L.T. R.F. Vibrator Choke	5/4

RADIOMAC
SCALES & NAME PLATES.

These high grade plates are available exclusively from Price's Radio. They are finished Nickle on black and improve the appearance of any equipment.

Condenser Scale 2¾in dia.	2/-
Condenser Scale 2in dia.	1/6
Condenser Scale 1¾in x 1¾in	1/6
Volume Control Scale 1¾in x 1¾in	1/6
Volume Control Scale 2¼in x 1¾in	1/6

Name Plates 1¼in x ¼in in the following titles are available:—

AC. DC.
Adjust
Aerial
Amplifier
Amplitude
Attenuator
Band Spread
Broadcast
Bass
Course
Earth
External
Fine
Focus
Gain
High
Input
240V AC
Intensity
Internal
Low
Microphone
Milliamps
Modulation
Off-On
Ohms
Oscillator
Output
Phones
Pickup
Play Back
Radio
Receiver
Record
Regeneration
50 cps
Selector
Short Wave
Speaker
Stand By
Sweep
Sync
Tone
Treble
Tuner
Volts
Volume
Wave Change
X Amp
X Plate
X Shift
Y Amp
Y Plate
Y Shift

6d ea.

CHOKES. Radio Frequency:—

Aegis C2. 1 pye. 2.5 mH	5/9
Aegis C3. 4 pyes. 2.5 mH	5/9
Bramco R.F. Choke 2.5 mH	5/-
R.C.S. 1 pye 2.5 mH	3/-
R.C.S. 3 pye 1.7 mH	5/6
R.C.S. 4 pye 2.5 mH	5/6
R.C.S. 5 pye 4.0 mH	5/6
R.C.S. 6 pye 7.0 mH	5/6

CABINETS.

A range of Gibbons and Denham cabinets is available to suit the more popular Radio and Hobbies sets including:—

Little General	39/6
Fireside Five	58/9
Rambler Portable	75/6
Record Player	105/-
Portagram	123/-
Speaker Cabinet 6in Standard	28/-
Speaker Cabinet 6in Deluxe	29/9
Speaker Cabinet 8in Deluxe	36/5
Speaker Cabinet 12in Deluxe	49/9
Metal case for test instruments 9in x 6½in x 5½in Brocade finish	43/3
Scope instrument case, with sloping front 12in x 8in x 8in	42/3

COILS, KITS, I.F. TRANS. etc.

R.C.S. Standard size 1 3/8in dia cans:—

Aerial Coil	10/2
R.F. Coil	10/2
Oscillator Coil	10/2
Reinartz Coil	10/2
I.F. Trans No. 1 and No. 2	16/6
I.F. Transformers Low Gain	20/-
I.F. Trans with Reaction	30/-

(The above are for broadcast band and 455 kc/s intermediate frequency)

BRAMCO Miniature broadcast coils in ¾in square cans. Iron Clad

MA2 Aerial	11/9
MRF2 R.F.	11/9
MO2 Oscillator (1R5)	11/3
MO3 Oscillator (6AN7/6J8 etc)	11/3
MO4 Oscillator (6BE6)	11/3
MO1 Oscillator Unshielded (1R5)	5/9
MIF1/2 455 kc/s IF Trans 1 & 2	17/3
Car Radio Coil Kit for Radio and Hobbies 5 valve Karset	72/6
Miniature Dual Wave Bracket	62/6

AEGIS COILS etc.

Standard size in 1 3/8in dia cans:—

M9 Broadcast Aerial	11/9
M10 Broadcast R.F.	11/9
M11 Broadcast Osc (1R5 ECH35 6J8 EK2 etc)	11/9
M11A Broadcast Osc (1A7)	11/9
M11B Broadcast Osc (6BE6)	11/9
M11D Broadcast Osc (6AN7)	11/9
J9 I.F. Trans No. 1 455 kc/s	15/3
J10 I.F. Trans No. 2 455 kc/s	15/3
J20 I.F. 455 kc/s medium select No. 1 and 2	22/6
J21 No. 3 to be used with J20	22/6
J24 I.F. Trans 10.7 mc/s	36/3
J25 Ratio Detector 10.7 mc/s	42/3

Miniature types ¾in square cans:—

M24 Broadcast Aerial	13/11
M 25 Broadcast R.F.	13/11
M26A Broadcast Osc (6AN7)	13/11
M26B Broadcast Osc (6BE6)	13/11
M26C Broadcast Osc (1R5)	13/11
M26D Broadcast Osc (6AE8)	13/11
J30 I.F. Trans No. 1 455 kc/s	20/9
J31 I.F. Trans No. 2 455 kc/s (J30/31 for 1.4V valves)	20/9
J32 I.F. Trans No. 1 455 kc/s	20/9
J33 I.F. Trans No. 2 455 kc/s	20/9
Car Radio Coil Kit for R & H 5 valve, with high gain aerial coil,	77/6

Miscellaneous Coils:—

M16 B.F.O. 455 kc/s	15/-
M22 Crystal Filter In. 455 kc/s	18/10
M22A Crystal Filter Out 455 kc/s	18/10
M23 C.R.O. Coil for 2000V HF supply	13/3
Whistle Filter Coil	14/6

Short Wave Coils:—

H4 Aerial Permatune 13-42 Metres	10/9
H5 R.F. Permatune 13-42 Metres	10/9
H6 Osc Permatune 13-42 Metres	10/9

CEMENT, ETC.

Tarzan Grip	1/9
PC 49. A general purpose adhesive	2/11
R.C.S. Coil Lacquer	3/-

CRYSTAL SET PARTS.

Germanium Diodes. The best fixed detector available	10/6
Tenatone Semi-fixed Detectors	9/-
Bramco Crystal set coils. Tapped	3/9

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CAPACITORS:—

Electrolytic

400 mF. 12V Peak	6/9
25 mF. 40V Peak	4/-
10 mF. 40V Peak	3/6
8 mF. 150V Peak	4/6
24 mF. 350V Peak	7/3
8 mF. 525V Peak	5/6
16 mF. 525V Peak	7/3
8 mF. 600V Peak	6/6
16 mF. 600V Peak	9/-

Paper Tubular

0.001 mF. 600V Working	1/-
0.002 mF. 600V Working	1/-
0.005 mF. 600V Working	1/-
0.01 mF. 600V Working	1/-
0.02 mF. 600V Working	1/3
0.1 mF. 600V Working	1/5
0.25 mF. 600V Working	2/3
0.5 mF. 600V Working	3/2
0.05 mF. 400V Working	1/1
0.1 mF. 400V Working	1/4
0.25 mF. 400V Working	1/10
0.5 mF. 400V Working	3/-
0.1 mF. 200V Working	1/-
0.25 mF. 200V Working	1/9
0.5 mF. 200V Working	1/11

Minicap. Midget Tubular.

Size A. 3/16in x 7/16in.:—

0.004; 0.005 and .01 mF.	200V.)	1/-
0.001; 0.002; 0.003 mF.	400V.)	
2.5; 4; 10; 50; 100 pF.	600V.)	
200; 250; 300; 500 pF.	600V.)	

Size B. ¼in x 9/16in.:—

0.02; 0.03; 0.04 mF.	200V.)	1/1
0.005; 0.01 mF.	400V.)	
0.001; 0.002; 0.003 mF.	600V.)	
0.004 mF.	600V.)	

Mica

Standard types for 500VW:—

10; 50; 100 pF)	1/-	0.001 mF.	2/-
200 pF. ..)		0.002 mF.	2/9
250 pF.	1/1	0.003 mF.	3/6
400 pF.	1/3	0.004 mF.	3/11
425 pF.	1/6	0.005 mF.	4/6
500 pF.	1/4	0.01 mF.	5/6

TRIMMERS: PADDERS ETC:—

Jabel Junior Trimmer, 3-30 pF.	1/-
Jabel Senior Trimmer, 3-30 pF.	1/5
Jabel 455 kc/s Padder	2/9
Jabel 2 Gang Trimmer	3/2
Jabel 3 Gang Trimmer	4/8
Jabel 4 Gang Trimmer	6/3
R.C.S. Trimmer, 3-30 pF.	1/3
R.C.S 455 kc/s Padder	4/-
Philips Air Trimmer	3/3

R.C.S. MIDGET VARIABLES.

Capacity.	No. Plates.	
10 pF.	2	8/-
15 pF.	3	8/6
25 pF.	4	9/-
35 pF.	5	9/8
50 pF.	7	10/6
75 pF.	11	11/4
100 pF.	14	12/8

PHOTOFLASH PARTS.

650 mF. 240V Condensers	42/6
Nova Reflectors	41/-
Nova Plastic Shield	7/6
SF15 Flash Tube	£5/4/5
Nova Trigger Transformer	39/-

TAPE RECORDER PARTS.

E.T.L. Record Heads	95/-
E.T.L. Erase Heads	95/-
Rex Oscillator Coils	15/6
Scotch Tape, 1200ft.	70/-
„ „ 600ft.	35/-

GANG CONDENSERS.

(for broadcast band)

A.W.A. Miniature, 2 gang	28/-
A.W.A. Miniature, 3 gang	37/3
A.W.A. Standard, 2 gang	27/5
A.W.A. Standard, 3 gang	36/8
Roblan Miniature, 1 gang	21/4
Roblan Miniature, 2 gang	29/10
Roblan Miniature, 3 gang	39/2
Roblan Miniature, 2 gang with built-in vernier	35/11
Jabel Standard, 1 gang	21/4
Jabel Standard, 2 gang	29/2
Jabel Standard, 3 gang	39/6

(Roblan & Jabel track with "H" dials.)

KITS

Complete kits of parts for home assembly can be supplied for all popular Radio & Hobbies designs.

Only the best quality components are included and each kit is complete to the last screw. A few recent models only can be listed, but we will be pleased to quote for any other design.

"Portaplayer", with cabinet and gramo-player unit	£29/-/-
"AC Standard Five" with 8in speaker	£20/10/-
"Wide Band Seven" with 12in Rola speaker	£35/5/-
"Playmaster No. 7" Amplifier, less speaker	£17/14/9
"Playmaster Control No. 4"	£7/8/6
"Long Range Five"	£20/10/-
"Crystal Pick-up Amplifier" less speaker	£17/19/6

CHASSIS.

A large range of chassis for popular Radio & Hobbies designs is available from stock. (Other types, delivery in 14 days.)

Williamson Amplifier	18/-
Advance, 1947	17/6
Simplified Super	19/6
Little General, 1951	13/9
Little General, 1952	15/6
Wide Band Six	19/6
Playmaster Amplifier, No. 1 & 2	18/6
Playmaster Amplifier, No. 3 & 4	13/-
Playmaster Amplifier, No. 6	15/9
Playmaster Tuner, No. 2	15/9
Karset, 1952. Complete	55/-
Karset, 1953. Complete	42/9
Instrument Case and Chassis	43/3
Little Jim and Panel	17/6
Rambler Portable	13/9
Portaplayer	20/6
Long Range Five	18/-

ELECTRICAL.

A comprehensive range of switches; plugs; sockets; connectors is available for all electrical uses.

DIALS.

The following Efco dials are complete with escutcheon and lamp fittings and are available with AWA or "H" calibrations.

MK17A. Kit dial, cord drive. Scale 2¾in x 2¼in. (Also 0-100)	17/2
USL/32A. Cord drive. Straight line. Scale 6½in x 3½in.	42/4
USL/37G. Cord drive. Straight line. Scale 5in x 1¾in.	37/2
SLV/21. Cord drive. Vertical straight line. Scale 2½in x 3½in.	37/2
USL/44. Cord drive. Straight line. Scale 5in x 3½in.	40/8
MSL/48. Straight line for Car radio. Scale 3⅜in x 1⅓in.	35/-
SLV/45. Cord drive. Vertical straight line. Scale 3½in. x 5in.	39/4
USL/46. Cord drive. Straight line. Scale 9¼in x 4¼in.	54/8
USL/51. As USL/46 but cream scale background	64/8
USL/50. Cord drive. Straight line. Scale 8in x 8in.	54/2

Replacement glass scales are available for the above dials.

GRAMO MOTORS.

B.S.R. 3 Speed with Turntable	£7/5/-
B.S.R. 3 Speed unit with Turnover Crystal Pick-up and automatic stop	£13/15/-
B.S.R. 3 Speed Record Changer	£22/10/-
Collaro 3 Speed unit with high fidelity Pick-up	£12/7/6
Collaro 3 Speed Record Changer	£19/17/6

GLOBES, LAMPS, etc.

A complete range of household globes, ornamental and decorative lamps, Fluorescent tubes and Automobile lamps is available.

Dial Globes. 6.3V M.E.S.	1/-
Dial Globes. 2.5 V M.E.S.	1/-
Dial Globes. 6.3V M.B.C.	1/3
Torch Globes. 2.5 and 3.8V	7d
Torch Globes. 1.1V	1/-
Torch Globes. 6V	1/-
Torch Globes. 2.5V Prefocus	1/7
Cycle Globes. 6V. 0.45A.	1/3
Neon Indicator. Miniature 80V.	3/9
Neon Indicator. Mounted. 240V.	9/-

HEADPHONES.

Brown type "X" A lightweight 2000 ohms headset. Ideal for crystal sets	39/-
Brown type "F". A featherweight 4000 ohms professional headset	65/-

KNOBS.

	Brown.	White.
Fluted ¾in dia.	9d	1/-
Fluted 1in dia.	1/-	1/3
Knurled 1½in dia.	2/-	2/-
G.R. type. Fluted 2½in dia. Black		10/-
As above with 3in skirt. Black		10/6
G. R. type. Fluted 1 1/8in dia. Black		2/3
Pointer Knob, 1¼in long. Black		1/-

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JACKS & PLUGS.

Aegis Phone Plugs	5/9
Aegis Open Ckt. Jack	4/9
Aegis Closed Ckt. Jack	6/-

MICROPHONES.

Ronette, B1108, Plastic Torpedo	79/7
„ HM7, Filtercell, Diecast. „ For hand or stand use	143/6
„ BDX, Crystal Head	35/-
Acos, MIC35, Diecast case	55/-
Zepherette, Torpedo type	46/9
Geloso Insert, M409	32/11
Mic; Chassis socket connector	6/1
Plug for above	7/11

POTENTIOMETERS.

I.R.C. Wire-wound in—10; 30; 100; 300; 500; 1000; 2500; 5000 and 10,000 ohms	10/6
I.R.C. Carbon type in 100; 500; 1000; 2500; 5000 ohms; 0.01; 0.025; 0.05; 0.1; 0.25, 0.5 and 1.0 megohms	7/-
I.R.C. Switch Pots, 0.5 and 1.0 megohms	12/8

PICK-UPS.

Goldring No. 137 Magnetic. 78 RPM.	49/6
Goldring No. 500 Variable Reluctance. High Fidelity for 78 and L.P. Recordings	£7/10/-
Goldring No. 500, head only	£5/5/-
Acos, HGP 40 High Fidelity with 2 interchangeable heads	£9/15/-
Acos, HGP 38 High Fidelity with turn over head	£5/15/-
Acos, GP20 Microcell type with two heads	£7/19/6
Acos, GP30, Standard turn over type	£4/17/6
Acos, HGP39 Heads (for HGP40)	£3/12/6
Acos, HGP37 Cartridge (for HGP38)	£3/17/6
Acos, GP19 Heads (for GP20)	£2/18/6
Acos, GP29 Cartridge (for GP30)	£2/10/-
Acos, GP9 Cartridge for old types	£1/11/6

RESISTORS.

A complete range of I.R.C. Resistors is available both in metallised and wire-wound types, from ½ to 20 watts.

Larger ratings are available to order.

½ Watt, types BTS. BT½ and BW½	9d
1 Watt, types BTA: BT1 and BW1	1/-
2 Watt, type BT2	2/-
3 Watt, type AA Wire wound	2/7
5 Watt, type AB Wire wound	3/3
20 Watt, type DG Wire wound, from	5/10

SOLDERING IRONS.

ELFO Standard 240V 60-watt with cord	42/6
Scope, 6 second Iron for 4 to 6-volt operation	50/-
Scope Transformer for using Scope Iron on 240V A.C.	47/11
Oryx. A real miniature Iron for 6V operation, 12W.	55/-

VALVES.

A comprehensive range of valves is available, both local and imported, including many old and difficult to secure types.

SPEAKERS.

(Complete with trans.)

JENSEN.

3PX	3½in PM	37/9
4PW	4in PM	39/2
525PW	5¼in PM	41/1
6PU	6in PM.	53/8
7PT	7in PM	60/7
96PU	9in x 6in PM.	63/5
12PU	12in PM. (3 ohm VC)	68/9
12PS	12in PM. (6.5 ohm VC	92/9
12PQ	12in PM. (12.5 ohm VC)	136/11
5E12	5in EM. (1500 ohm field)	48/1
6E30	6½in EM. (1000 ohm field)	59/-
7E12	7in EM. (1500 ohm field)	68/7
7E13	7in EM. (1000 ohm field)	68/7
12E30	12in EM. (1500 ohm field)	106/7

PRICE'S RADIO IS THE STORE FOR TOYS FOR BOYS

Their range includes:-

- MECCANO SETS
- MECCANO ACCESSORY SETS
- HORNBY MECHANICAL TRAINS
- DUBLO ELECTRIC TRAINS
- DINKY TOYS
- MINIC MECHANICAL TOYS
- GAMA TOYS
- TRIANG TRAINS
- SAILMASTER YACHTS

etc., etc.

Price list will be available early November, write for your copy now.

ROLA.

3C	3in PM. (E Trans)	38/2
5B	5in PM. (L Trans)	33/7
5F	5in PM. (D Trans)	50/8
6H	6in PM. (D Trans)	52/2
6L	6in PM. (D Trans)	65/11
8K	8in PM. (C Trans)	60/3
8M	8in PM. (C Trans)	71/11
12M	12in PM. (C Trans)	86/9
12-O	12in PM. (C Trans)	110/9
12-O	12in PM. De Luxe. (No Trans)	102/10
12-OX	12in PM. (No Trans)	174/10
12U	12in PM. (No Trans)	£16/10/10

Whilst a large range of speakers are stocked, we cannot guarantee to be able to give immediate delivery of any one model.

TOOLS.

HOME UTILITY. Quality products manufactured by Black & Decker.

Utility Electric Drill, ¼in	£12/16/-
Orbital Sander	£26/4/6
Vertical Drill Stand, ¼in	£7/-/-
Horizontal Drill Stand, ¼in.	£1/14/3
Sanding and Polishing Kit	£2/4/6
Grinding and Buffing Kit	£1/16/6
Abrasive Kit	£1/16/-

SPEAKER TRANSFORMERS

Jensen

"XJ" for 3in model	11/1
"XA" for all except 12PS 12PQ and 12E30	11/9
"TU" for 12PS and 12E30	21/11
"TX" for 12PK	25/5

Rola

"C"	21/7
"D"	17/6
"E" and "F"	16/-
"L"	15/5
Bramco replacement for all small Rola and Jensen	10/6

EXTENSION SPEAKERS.

Aegis Junior. Plastic Case complete with 5in speaker.
Brown or Black 45/-. White 47/6

BRAMCO SPEAKER WINDINGS.

A type to suit all speakers. 2500; 5000; 7000; 10,000 and 15,000 ohms impedance. Priced from 6/9

Please advise make and model of speaker when ordering.

ALUMINIUM CHASSIS BLANKS

6in x 4in x 2in	18 gauge	6/8
8in x 5in x 2in.	18 gauge	9/-
10in x 6in x 2½in.	18 gauge	10/8
10½in x 8in x 2½in.	18 gauge	13/-
13in x 10in x 2½in.	16 gauge	20/-

SWITCHES.

Jabel Miniature Wafer:—1 pole, 12 position; 2 pole, 6 position; 3 pole, 3 position; 4 pole, 3 position 9/9

Oak Wafer types:—

1 pole,	11 position,	1 bank	11/2
		2 „	18/3
		3 „	25/-
1 „	12 „	1 „	13/3
		2 „	22/11
		3 „	30/11
2 „	4 „	1 „	10/10
		2 „	17/5
		3 „	23/10
2 „	5	1 „	10/10
		2 „	17/5
		3 „	23/10
3 „	3 „	1 „	10/10
		2 „	17/5
		3 „	23/10
4 „	2 „	1 „	10/10
		2 „	17/5
		3 „	23/10
6 „	2 „	1 „	13/3
		2 „	22/11
		3 „	30/11

Alpha. (Suitable for 240V AC).

Type	A. SP, DT.	Toggle	7/2
„	D. DP, ST.	„	10/10
„	F. DP, DT.	„	13/8
„	C. SP, DT	Rotary	8/10
„	E. DP, ST.	„	13/8
„	G. DP. DT.	„	15/10

PRICE'S RADIO

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BUYERS GUIDE 1954/55

SPAGHETTI

Cambric Varnished	1mm	yd	5d
Cambric Varnished	1½mm	yd	6d
Cambric Varnished	2mm	yd	7d
Cambric Varnished	4mm	yd	10d
Plastic Sleeving	1mm	yd	1½d
Plastic Sleeving	2mm	yd	3d
Plastic Sleeving	4mm	yd	5d
Plastic Sleeving	6mm	yd	7d
Plastic Sleeving	10mm	yd	1/-

SUNDRIES

Machine Screws:—

RH Brass. 1/8in Whit. 3/8in long.	Doz.	7d
½in long.	Doz.	8d
¾in long.	Doz.	9d
1in long.	Doz.	10d
2in long.	Doz.	2/-
Brass Nuts for above	Doz.	5d
Tinned Lugs. Double ended	Doz.	3d
Tinned Lugs. Single ended	Doz.	4d
Brass Washers. 1/8in hole	Doz.	3d
Bakelite Washers 1/8in hole	Doz.	6d
Grid Caps for Octal valves	Doz.	2/-
Grid Caps for large valves	Doz.	2/-
Insulated 807 Caps	Ea.	3/9
Dial Cord. Woven Cotton		9d
Dial Cord. Nylon		2/-
Dial Lamp Holders. MES with bracket	Ea.	6d
Batten type	Ea.	1/3
MBC type	Ea.	1/-
Jabel Spring Terminals in 5 colors		9d
Goat Valve Shields	Ea.	1/-
Fuse Holders, Clip type	Ea.	6d
Fuses. 250 mA to 25 amp	Ea.	9d
Grommets, 5/16in hole	Doz.	2/-
Grommets, 3/16in hole	Doz.	1/6
Shaft Couplings ¾in	Ea.	1/3
Extension Shafts ¼in to ¼in	Ea.	1/3
Extension Shafts ⅜in to ¼in	Ea.	1/9
Reducing Split Bushes 3/8in to ¼in	Ea.	7d
Tuning Eye Escutcheons	Ea.	1/3

Mounting Strips:—

2 lugs	Ea.	3d
3 lugs	Ea.	4d
4 lugs	Ea.	5d
5 lugs	Ea.	6d
6 lugs	Ea.	7d
7 lugs	Ea.	8d
8 lugs	Ea.	9d
Panels 6in. 12 pairs lugs		2/6
Panels 12in. 24 pairs lugs.		4/6
Grub Screws. 5/32in	Doz.	9d
Star Lock Washers. 1/8in	Doz.	3d
Star Lock Washers. 5/32in	Doz.	3d

MBC Auto Connectors.—

Fuse Holder for leads	1/3
Connector	1/3
Chassis Socket and Plug	2/-

VIBRATOR CARTRIDGES

V5105.	Non-sync.	4-pin.	6V	32/3
V5123.	Non-sync.	4-pin.	12V	33/5
V5124.	Sync.	6-pin	6V	39/11
V5258.	Sync.	6-pin	12V	39/11
V5211.	Split Reed.	7-Pin.	6V	42/11
V5984.	Split Reed.	7-pin.	12V	49/8

Other types and voltages to 32, available to order.

VOLTAGE DIVIDERS

R.C.S. 25,000 or 15,000 ohms	8/-

WIRE, CABLES, etc.

Plastic 7/010 Hook-up Wire per yd	3d
Cotton Covered 10/010 Hook-up wire. While stocks last per yd	3d
Tinned Copper 17SWG per yd	3d
Tinned Copper 20SWG per yd	1d
Twin Shielded Cable per yd	1/6
Miniature Shielded for pick-ups	1/6
Auto Wire 3mm Plastic per yd	1/-
Auto Wire 4mm Plastic per yd	1/6
Microphone Cable. Shielded per yd	2/3
Twin Plastic 23/36 per yd	9d
Twin Cotton Covered 23/33 per yd	1/3
Three Core Covered 23/36 per yd	1/9
Three Core Covered 40/36 per yd	2/3
Three Core Rubber & Plastic per yd	2/-

LINE FILTERS

Reduce that electrical noise.

Bramco or R.C.S.	37/6

AEROSTAT POTENTIOMETERS 0.5 and 0.05 meg.	2/-
MORGANITE MIDGET POTENTIOMETERS. 0.025 and 0.05 meg.	3/-
F.N. MINIATURE 2-GANG CONDS. Solid dielectric	3/6
WAFER SWITCHES. 3 x 2 and 2 x 3 one bank	2/-
STC I.F. TRANSFORMERS. 455 kc/s, Square cans	2/-
6-VOLT M.B.C. LAMPS. Car indicator, etc.	6d
LEAD-IN STRIPS. Window type, flexible with clips	6d
SPEAKER TRANSFORMERS. Rola "C". 10,000 ohms	5/-
VALVE SOCKETS. Octal Wafer type	6d
Amphenol 4-pin Mfg type	2d

TEST EQUIPMENT Meters etc.

University:—

DCM. DC Multimeter	£10/13/9
ACM. AC/DC Multimeter	£14/1/3
MVA/2. AC/DC Deluxe Multimeter	£18/11/3
MK1. AC/DC Multimeter Kit, for home assembly. Full instructions and diagrams supplied	£ 12/7/6
OK1. Battery Oscillator Kit. No calibration required after assembly	£12/7/6
YOA. AC Test Oscillator	£40/10/-
YOB. Battery Test Oscillator	£40/10/-
TST. Valve and Set Tester. AC/Vib.	£68/-/-
0-1 mA Meters. 100 ohms 3¼in dia.	£4/7/9
0-1 mA Meters. 100 ohms 4in x 4¼in	£4/19/-

Meters in most sizes and ranges can be supplied to order.

I.R.C. 1W Multiplyers 1 pc accuracy 0.01, 0.025, 0.05, 0.1, 0.25, 0.5 and 1.0 megohms	2/4
Shunts for 100 ohm meters, for 10 25, 50, 100, 250 and 500 mA	3/6
Jabel Test Prods. Red and Black. Pr.	2/9
Jabel Aligning Tools for modern coils	2/9
University Test Leads. Complete	11/10
Banana Plugs	8d
Sockets for above	8d

TRANSFORMERS

National:—

30/150.	150/150V at 30 mA	28/11
40/285.	285/285V at 40 mA	43/1
50/225.	225/225V at 50 mA	43/9
60/285	285/285V at 60 mA	52/-
80/285.	285/285V at 80 mA	59/6
100/285.	285/285V at 100 mA	66/-
125/285.	285/285V at 125 mA	83/6
150/285.	285/285V at 150 mA	87/10

The above power transformers have normal filament windings and are available either for horizontal or vertical mounting. HT of 325 and 385 are also available.

Ferguson:—

PF619.	150/150V at 30 mA	29/6
PF299.	285/285V at 40 mA	42/6
PF201.	225/225V at 50 mA	41/-
PF151.	285/285V at 60 mA	50/-
PF130.	285/285V at 100 mA	62/6
PF174.	285/285V at 150 mA	82/6
PF173.	425/425V at 175 mA	150/-
PF140.	385/385V at 200 mA	149/6

The above include filament windings.

Vibrator Transformers:—

VT101.	6V in to 90V at 15 mA	32/6
VT102.	6V in to 150V at 25 mA	37/6
VT127.	6V in to 200V at 50 mA	42/6
VT107.	6V in to 250V at 50 mA	43/6
VT132.	12V in to 200V at 60 mA	45/-
VT117.	12V in to 250V at 60 mA	45/6

Battery Charger Transformer:—

PF265. 17V at 4.2A tapped at 11.5; 10 and 8.5V	63/6

A large variety of Ferguson power and special transformers can be supplied to order. Please write for quotation.

Ferguson Output Transformers:—

No.	Pri:Z.	Sec: Z.	Watts	
OP1	5K/2.5K SE	12/8/2	10	60/-
OP5	10/6/5K PP	12/8/2	10	90/-
OP112	10K PP	2	6	87/6
OP113	5K SE	2	6	87/6
OP19A	5K PP	12/8/2	15	137/6
OP63	10K PP	15/3.7	15	142/6
OP65	10K PP	8/2	15	142/6
OP25/15	10K PP	15/3.7	15	165/-
OP25/8	10K PP	8/2	15	165/-

TORCHES

Cycle Lamp (uses 2 No. 950's)	9/9
Pocket Torch (uses No. 203)	7/6
Standard Torch (uses 2 No. 950's)	10/9
Junior Torch (uses 2 No. 729's)	3/9

(All complete with battery)

VALVE SOCKETS & PLUGS

Amphenol with mtg plates: 4, 5, 6, 7 and 8-pin (octal)	1/1
Amphenol Mfg type with ring	1/1
Teletron Mini 7-pin Black	1/1
Teletron Mini 7-pin Mica	1/6
Teletron Mini 7-pin and Shield	5/2
Teletron Noval. Black	1/3
Teletron Noval. Mica	1/9
Teletron Noval and Shield	9/9
Aegis Ceramic Acorn	6/3
Aegis Ceramic Octal	6/3
Teletron Mini 4-pin Socket	9½d
Teletron Mini 4-pin Plug	10½d
Amphenol Plugs: 4, 5 and 6-pin	1/3
Amphenol Plugs. 7-pin and Octal	1/6
Amphenol Covers for above	6d
Amphenol Mounting Plates	3d
Amphenol Split Rings	1d

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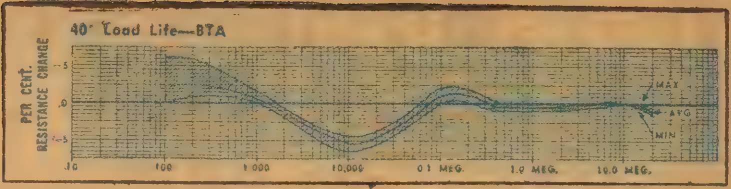
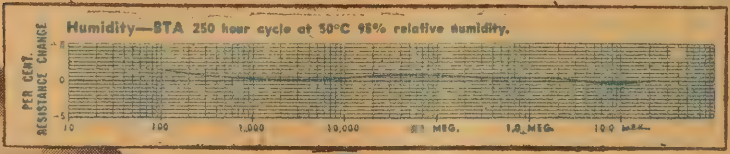




IRC
AUSTRALIA

REVIEW YOUR RESISTOR REQUIREMENTS IN THE LIGHT OF THESE ADVANCED RESISTORS

New

IRC
AUSTRALIA

MINIATURE TYPES BTS & BTA RESISTORS

REFERENCE CHART IRC TYPE BT RESISTORS

IRC TYPE	RATING @ 40° C. AMBIENT	LENGTH	DIAMETER	LEAD LENGTH	LEAD DIAMETER	RATED VOLTAGE	MINIMUM RESISTANCE	MAXIMUM RESISTANCE
BTS	½ watt	13/32"	⅛"	1½"±⅛"	.032"	350V	*82 ohms	22 meg.
BTA	1 watt	23/32"	¼"	1½"±⅛"	.040"	500V	*100 ohms	22 meg.

* Lower values under development.

obsolete all present standards!

STANDARD RESISTANCE VALUES FOR TYPE BTS & BTA

In accordance with RMA Resistance Values

RMA VALUE	TOLERANCE			OHMS				MEGOHMS		
Add 0's for higher resistances	5%	10%	20%	10 to 91	100 to 910	1,000 to 9,100	10,000 to 91,000	0.1 to 0.91	1.0 to 9.1	10 to 91
10	*	*	*	—	100	1,000	10,000	0.1	1.0	10.0
11†	*			—	110	1,100	11,000	0.11	1.1	11.0
12	*	*		—	120	1,200	12,000	0.12	1.2	12.0
13†	*			—	130	1,300	13,000	0.13	1.3	13.0
15	*	*	*	—	150	1,500	15,000	0.15	1.5	15.0
16†	*			—	180	1,600	16,000	0.16	1.6	16.0
18	*	*		—	180	1,800	18,000	0.18	1.8	18.0
20†	*			—	200	2,000	20,000	0.20	2.0	20.0
22	*	*	*	—	220	2,200	22,000	0.22	2.2	22.0
24†	*			—	240	2,400	24,000	0.24	2.4	—
27	*	*		—	270	2,700	27,000	0.27	2.7	—
30†	*			—	300	3,000	30,000	0.30	3.0	—
33	*	*	*	—	330	3,300	33,000	0.33	3.3	—
36†	*			—	360	3,600	36,000	0.36	3.6	—
39	*	*		—	390	3,900	39,000	0.39	3.9	—
43†	*			—	430	4,300	43,000	0.43	4.3	—
47	*	*	*	—	470	4,700	47,000	0.47	4.7	—
51†	*			—	510	5,100	51,000	0.51	5.1	—
56	*	*		—	560	5,600	56,000	0.56	5.6	—
62†	*			—	620	6,200	62,000	0.62	6.2	—
68	*	*	*	—	680	6,800	68,000	0.68	6.8	—
75†	*			—	750	7,500	75,000	0.75	7.5	—
82	*	*		82	820	8,200	82,000	0.82	8.2	—
91†	*			91	910	9,100	91,000	8.91	9.1	—

* Shows values available in tolerances indicated.
† 5% values only; 10% & 20% values NOT available.

TOLERANCES: Available in ±5%, ±10% and ±20% tolerance . . . in accordance with RMA values.

PRICES: BTS, 9d; BTA, 1/-

Write or phone your supplier for full details

IRC miniaturised Type BT **insulated** Fixed Composition Resistors have set new performance standards which will affect your planning for years to come. Exhaustive tests by independent agencies have proved the superior performance of these resistors under actual field conditions, as well as in the testing laboratory. Check the graphs and tables carefully.

STANDARD RESISTANCE VALUES

Type BTS and BTA Resistors are supplied ONLY in RMA Resistance Ranges (Radio Manufacturers' Association), subject to minimum and maximum values for each type. These standard ranges are listed at left.

SOLE AGENTS FOR AUSTRALIA
Wm. J. McLELLAN & Co.
Pty. Ltd.
[illegible]
(50 yards north of King Street)

TRADE REVIEWS AND RELEASES

GOODMAN'S AXIETTE SPEAKER

An unfortunate requirement of a really good loud speaker is that it is costly. Huge magnet structures and big cones, apart from the extra rigidity to go with high power, all run away with considerable amounts of money.

IF, however, one is able to use a unit which does not require a large power rating, it is possible to make a very good speaker at greatly reduced cost.

Goodman's, world famous makers of quality speakers, thinks enough of this idea to bring out an entirely new design, with a power handling capacity of 5 watts and an 8in cone diameter.

Such a speaker will find many uses where high power isn't required, and this will probably fit most cases other than dyed-in-the-wool high-fi fans.

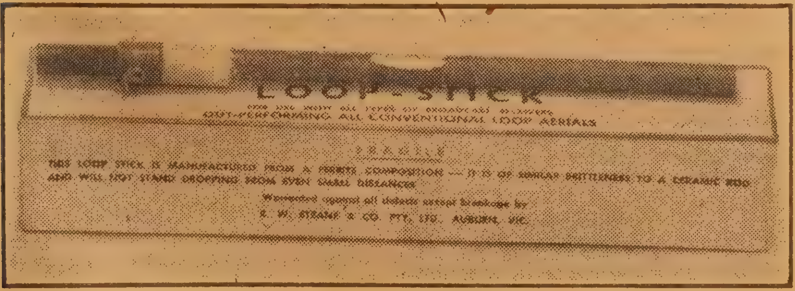
The cone has a resonance of 50 cycles, and although a single unit, has a top frequency range in excess of 10 Kc.

This means that, properly baffled, it will give a really good account of itself, without requiring the large enclosures demanded by its big brothers.

On test, we found it to do just that. Its efficiency was quite good for its size, its output was commendably smooth, and although output at low frequencies was naturally less than with the big speakers, it was adequate and of good quality.

Our test speaker came from British Merchandising Co., of Sydney, the Australian representatives for Goodmans.

The new Goodmans Axiette 8-inch speaker



Illustrated above — the Q-plus Loop-stick aerial

Q-PLUS LOOP-STICK

ILLUSTRATED at the left is the new Q-plus loop-stick aerial of the type now gaining popularity with portable receivers.

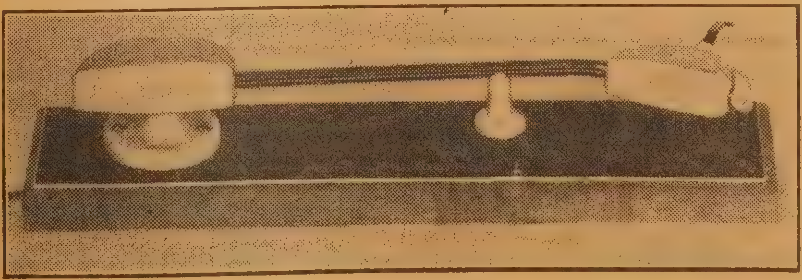
Wound on a Ferroxcube "stick" core, the aerial replaces the old-fashioned loop aerial, with at least equivalent pick-up and a great saving in space. The aerial has an average Q of 230.

The Q-plus LA1 Loop-stick sells for 23/9.

RONETTE "FONOFLUID" CRYSTAL PICK-UP

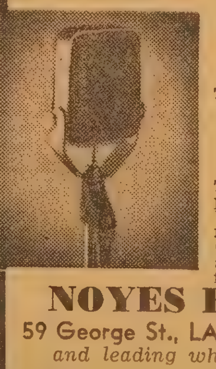
AFTER having marketed "Ronette" crystal pickup cartridges for some time, AWA have now announced the release of a complete Ronette Crystal pickup. Finished in chromium and cream plastic, the pickup is a very attractive unit and comes complete with rest and finger loop. Needle point pressure is adjustable and the cartridge is a turnover type.

The unit tested in our laboratory had the general-purpose TO-284-OV cartridge fitted, intended for use in ordinary radiograms and requiring little or no compensation.



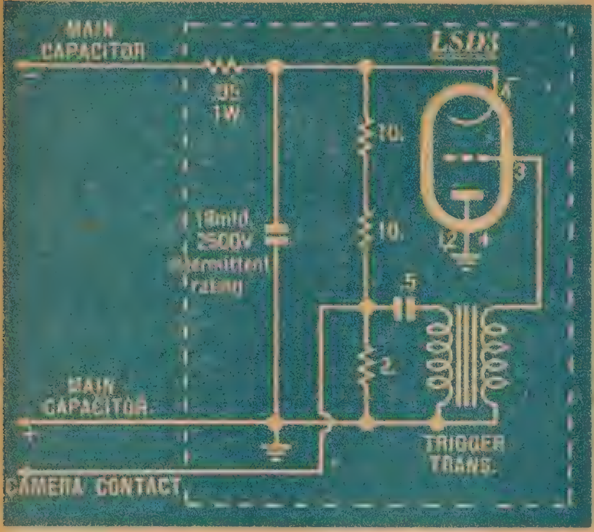
AWA RONETTE

MICROPHONES & ACCESSORIES

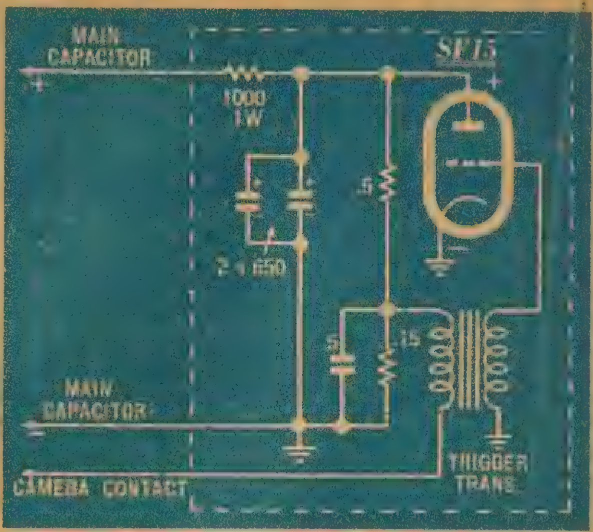


Type RFC5
£12/11/6
(High impedance),
Type RFC5/L
£15/8/11
(Low impedance, 200 ohms.)
Technical pamphlets will be mailed on request.
Other types also available from

NOYES BROS.
59 George St., LAUNCESTON
and leading wholesalers.



The circuit of an auxiliary lamp for use with the high voltage Electro-Flash. Note that the main capacitor has approximately half the value of that in the main unit. The trigger transformer and other components are identical with those of the main unit.



The circuit of a similar unit for use with the Low Voltage Electro-Flash. Note that in each case a lead must be run to the camera contacts to fire the second unit, making three leads in all. Construction is similar to the main unit.

EXTRA GUN FOR YOUR FLASH

A valuable addition to any electronic flash system is a second lamp which can be used to provide improved modelling of the subject. In this article we describe how such a unit may be attached to either the high or low voltage Electro-Flash units described in earlier issues.

by Philip Watson

FOLLOWING the publication of both the high and low voltage electro-flash units we had requests from readers for a method whereby two lamps may be flashed simultaneously from the one unit. Since the low voltage electro-flash was described (April, May, June, 1954), the requests have become more insistent than ever, so we set out to see what could be done about modifying both units for this extra feature.

Before delving into the technicalities of how to achieve this, it might be worthwhile to consider why it is desirable. It is generally considered that a single light source, mounted on the camera, is about the worst possible example of artificial lighting, and is used only because it is an extremely convenient one. In many applications, notably press work and candid photography, this advantage far outweights its disadvantages.

FLAT LIGHTING

The main disadvantage is that the resultant picture is unduly "flat". The explanation for this is fairly simple. Since a photograph can only reproduce two dimensions, the roundness of a subject, such as a face, can only be shown by the fine tones of light and shade appearing on it.

When the light occupies approximately the same position as the viewer (ie, the camera) all parts of the object which are visible will receive almost identical illumination, and there are few shadows to imply that the surface is anything but flat. Thus a sphere illuminated in this manner can be made to look like a disc, whereas, if it is lit from the side, the gradual shading from the highlight to shadow side will provide a subconscious clue as to its real shape.

The flat lighting from a single source on the camera will be aggravated if there is any tendency to over-exposure, since whatever delicate shadows were present, on the original, will be lost if the highlights are "burnt out". This fault is frequent in the case of flash bulbs, since they often provide much more light than can be controlled by the diaphragm alone.

In the case of electronic flash there is not the same tendency to over expose, and any delicate shading present can usually be captured. At the same time it is still possible to over-expose on close-ups, unless precautions are taken against it.

DIFFERENT APPROACH

Assuming that the exposure is correct, quite good results can be obtained with many subjects with only a single light source mounted on the camera, but other subjects obviously call for a different approach.

Reverting to the case of the sphere, we mentioned that a more realistic impression was obtained when the light struck it from one side and this is the first clue to improved lighting.

In practice it means taking the main light off the camera and moving it to one side of the subject so that it strikes it at about 45 degrees.

Unfortunately, this is not sufficient by itself. The shadows formed by such side lighting will be too dense to reproduce properly in the finished print, an effect which is aggravated by the limited range of shadow tones possible on normal prints.

This is where the second lamp comes in, and it should be mounted on the other side of the subject, also at about 45 degrees, where it will illuminate the shadows to the point where they will retain essential detail, but still appear considerably darker than the highlight side.

LOWER POWER

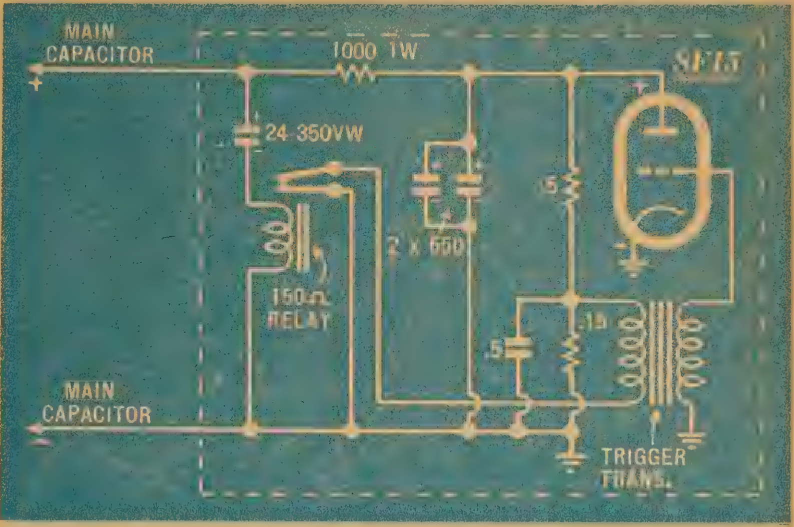
Obviously this second lamp must not be as powerful as the main light, otherwise it will eliminate the shadows almost completely and we would be back where we started.

The second light may be made weaker by moving it farther away, using a smaller lamp, adding diffusion devices in front of it, or combinations of these. The exact amount by which it should be reduced relative to the main light is dependent on many factors, but a ratio of two to one is a good basis on which to experiment.

The above is necessarily a brief discussion on only one aspect of artificial lighting. In practice you will find that there are unlimited variations on the above theme, though, for the most part, they are only variations, and the basic idea remains the same.

So much then for the need for a second light. Now we must consider ways and means of achieving it with an electronic flash unit. At first glance it might be thought that the problem merely involves connecting a second lamp in parallel with the first and allowing it to take its share of the power from the main capacitor, increasing this in value if necessary.

A MODIFIED TRIGGER CIRCUIT



An alternative arrangement whereby the trigger circuit need not be extended to the camera. Discharge of the 24mfd capacitor through the main lamp energises the relay which closes the trigger circuit. A two wire cable only is needed for this unit but there is small delay in firing the second lamp.

THE PROBLEM

Unfortunately, it is not quite as easy as that. The difficulty is caused by the fact that we cannot ensure that both lamps will ionise at exactly the same instant, even though the difference may only amount to a few microseconds. In these circumstances the first lamp to ionise will "snatch" all the energy from the capacitor, thus preventing the second lamp from firing at all.

To overcome this we must supply each lamp with its own capacitor and triggering circuit, connecting them together in such a way that the capacitors will charge as a single unit, but discharge separately through their respective lamps.

We have worked out circuits and values to enable this to be done with both the high and low voltage electro-flash systems, the second lamp being treated as an auxilliary unit to be added only when required.

A suggestion which immediately comes to mind is that an existing high voltage unit may be modified in this way and thus converted into a studio unit, a low voltage unit being built for portable work. When used only for studio work there would be no objection to fitting the lamps with larger and more efficient reflectors, such as are normally available for photoflood lamps,

Reference to the circuits will give some idea of what is involved, each auxilliary unit being similar to the capacitor-triggering portion of the main unit.

ISOLATING RESISTOR

The most important addition is that of an isolating resistor in one lead connecting to the main unit. The value of this must be so chosen that it will allow both capacitors to charge at essentially the same rate, yet be high enough to effectively isolate them for the few microseconds necessary for the slower lamp to fire.

In the case of the high voltage unit, this resistor also serves as a safety device by limiting the current which can flow from the auxiliary capacitor in the event of accidental discharge. For this reason we made it as high as possible, consistent with satisfactory working.

In practice the value does not appear to be very critical, and we merely selected the highest value which would permit the second capacitor to charge at essentially the same speed as the main one. It is likely that the value could be halved without affecting performance.

In considering the charging rate of the second capacitor we have to consider what value this is going to be and, on the assumption that the second lamp should have approximately half the light of the main one, it would seem reasonable to suggest that approximately half the value of capacitance would be the best arrangement. However, you can please yourself in this regard, remembering that the greater the capacitance the longer the charging time.

For the high voltage unit we suggest an 18 mfd capacitor when a 28 or 33 mfd is used in the main unit. The .05 meg. isolating resistor can be of 1 watt rating.

TRIGGERING

Triggering is achieved by providing a second trigger transformer in the auxiliary gun, the connection across the voltage divider being the same as in the main unit. The only part omitted is the neon indicator, which is not needed.

One lead from the triggering circuit must run to the camera contact exactly as with the main unit, and this means that the extension lead will have to be of the three-core variety.

In choosing this cable it must be remembered that the voltage involved is high (2500) and the amount of energy stored considerable, being quite sufficient to deliver a fatal shock. For this reason safety must be the first consideration.

CABLE REQUIREMENTS

At the same time it is desirable to make the cable as light as possible in order to facilitate the mounting of the lamp on a light tripod, without fear that the weight of the cable will pull it over. Fortunately the current being carried during the charging cycle is not heavy and the resistance of the wire is not important, so that it only remains to choose a wire which has adequate insulation properties.

At these voltages rubber insulation is definitely not recommended, unless it is of a special type. The plastic insulations are very much superior, both in their insulation properties and the fact that they do not deteriorate appreciably with age.

Ordinary twin plastic appears to be quite satisfactory electrically and it would be quite feasible to use this in conjunction with a third conductor of lighter gauge, such as hookup wire, the whole being encased in a length of plastic tubing.

A more convenient arrangement is to use three-core plastic insulated appliance flex, either cotton covered or, better still, plastic sheathed. Typical of these is Telcon TA9-27C, consisting of three cores of 23/.0076 in plastic insulation and cotton outer covering, and Telcon TA9-29 having similar conductors but an outer plastic sheath.

It is well to realise that not all plastic-sheathed appliance cables are

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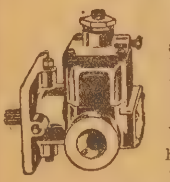

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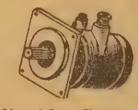

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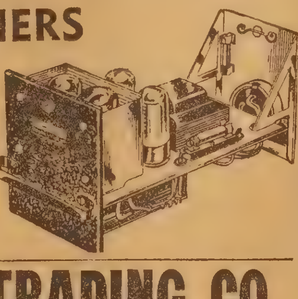

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6F6G		15	0
6G6		12	6
6H6		12	6
6J7G		12	6
6K7		12	6
6L7G		15	0
6SH7		7	6
6SJ7		12	6
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6SN7		12	6
6SS7		12	6
6X5		12	6
801	£1	2	6
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813	£3	0	0
866	£1	0	0
9003		10	0
9004		10	0
954		10	0
955		10	0
12A6		12	6
12AH7GT		12	6
12C8		12	6
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plastic insulated, many being rubber insulated and quite unsuitable for this purpose.

ADAPTOR

For connection to the main unit, some form of adaptor will be necessary, since it is unlikely that there will be room on the original unit for an extra socket. In any case, we must still remember that high voltages are being used and any plugs and sockets should be of high quality insulation.

A suitable adaptor could be made using a ceramic socket and a 1¼in diameter plastic coil former with a plug-type base. The coil former could be cut down to about half its length, the socket mounted in the top of it, and secured with tinned copper wire connections to the base pins. A hole in the side would provide entry for the extension cable.

We would warn particularly against disconnecting the auxilliary unit from the main unit without first discharging the system, since the plug pins of the auxilliary lead will have across them any voltage present across the auxilliary capacitor. The discharge rate will be limited by the .05 meg resistor, but it could still deliver an unpleasant shock.

To accommodate the extra lead for the triggering circuit it would be best to change the original four-pin socket in the main unit for a five-pin type, using a five-pin coil former and five-pin socket for the adaptor and a five-pin plug on the cable from the main gun. This will enable the triggering circuit from the main gun to be brought down to the adaptor and thence to the remote unit. In this way all connections are automatically taken care of when the second unit is plugged in.

The first circuit for the low voltage unit follows on almost identical lines to the high voltage unit, the main change being the reduction of the isolating resistor to 1000 ohms. Again a 1 watt rating is sufficient.

For the capacitors we suggest two 650 mfd 250 volt units, assuming that four of this type are used in the main unit. Assuming only two in the main unit, one in the extension unit would probably be sufficient.

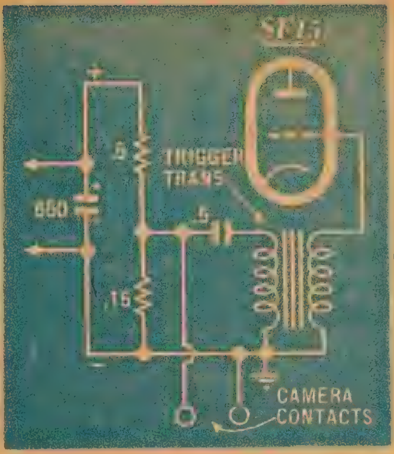
EXTRA SOCKET

There is likely to be more room available in the low voltage unit for an extra socket to accommodate the extension lead, and this would seem to be the best scheme. As with the high voltage unit, the triggering circuit from the main gun should be brought to the extension socket so that this connection is taken care of automatically.

In place of the original two circuit connector (one active and one frame) it will now be necessary to use a three circuit type (two active and one frame) for both the main gun and extension circuits. Such connectors are available in at least two brands, the socket being a panel mounting type and the plug a cable connecting type.

Extension cable for the low voltage unit does not present the same problems as with the high voltage unit, since the voltage is no greater than that for which ordinary domestic appliance flex is designed. Thus three-core rubber insulated cotton-covered flex should be quite satisfactory.

The second low-voltage circuit provides a system whereby the triggering circuit need not be run back to the main unit, making it possible to operate the extension unit with only a two-core cable. Ordinary twin plastic would be ideal for this arrangement.



A triggering circuit for use with the Low Voltage Electro-Flash when an ignition coil is used as a trigger transformer. It permits one side of both windings to be brought to a common terminal.

FIRING DELAY

Offsetting the advantage of the simpler connections is the fact that there will be a few milliseconds delay between the firing of the main and extension lamps. This will effectively increase the exposure time in terms of subject movement, though it will still be a fast exposure compared with most shutter speeds. Whether you can accept this limitation will depend on the type of work you intend to do.

Reference to the circuit will show that the remote trigger circuit is operated by a relay, the main point of interest being the manner in which the relay is energised.

This is best explained by regarding the 24 mfd. electrolytic as part of the storage capacitors in the main unit, it being connected on the side of the isolating resistor remote from the extension unit, even though it is mounted in the unit. When the capacitors are charged this capacitor is charged also, the current flowing through the relay winding, but being too small to operate it.

When the main lamp fires and the main capacitors discharge through it, the 24 mfd. unit also discharges through it and the sudden surge of current is sufficient to snap the relay shut and close the local triggering circuit. In practice the two lamps appear to fire simultaneously, though we have not been able to check exactly how much delay actually occurs.

THE RELAY

The relay we used was an ex-disposal type, having a winding resistance of 150 ohms. This value would not be critical and anything around a few hundred ohms should be suitable. If too high, the reaction might be unduly slow, but this could be overcome by increasing the capacitance, say, to double the present value. The relay need only close a single circuit.

We considered trying the same scheme with the high voltage unit, but decided that it was hardly a practical proposition. It would probably need a capacitor of between .5 and 1 mfd. with a voltage rating of 2500, and these retail at something like £3, besides being rather bulky and not a standard item. To this must be added the cost of a relay and the fact that the delay introduced would be more objectionable with a high voltage, high speed, unit than with the slower types.

All things considered, we reasoned it would be cheaper and more satisfactory to run a third wire for the triggering circuit.

The construction of the units does not call for any comment, since it will follow the same general lines and use similar components to the main units, with which we assume that the reader is already familiar. Thus the same reflector, gun assembly, trigger, transformer, &c., would

(Continued on Page 112)

THE "ACOS" MAGNETIC PICKUP

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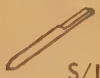
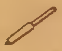
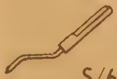
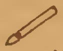
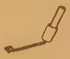
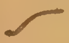
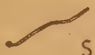
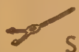
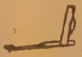
NEEDLE STYLUS REFERENCE CHART No.2

Recommended replacement types and Fitting Instructions

Check for detail only . . . Styli are not necessarily shown in actual size.

TYPE	RECOMMENDED FOR	Instructions for Needle Change.	PRICE
 S/1	Light crystal pickups	Tighten with Needle Screw.	10/6
 S/3	Connoisseur, Goldring 121, 122, H.M.V. and other lightweight pickups	Insert without side pull or bending, as deeply as possible.	10/6
 S/6	Record changers and both crystal and magnetic pickups, minimising record wear	Tighten with Needle Screw.	10/6
 150	Goldring 3-way pickup	Insert without side pull or bending, as deeply as possible.	12/6
 S/7	Goldring turnover pickup, B.S.R. unit GU.4, Stromberg-Carlson changer, Garrard changer, Acos pickup, etc.	Turn cartridge until styli holding screw in centre of cartridge shows. By unscrewing it, both styli can be withdrawn simultaneously and new styli inserted, making sure that the flats of these go inside.	12/6
 S/8	B.S.R. monarch record changer.	Fitting Instructions for Types S/8, S/9, S/10, S/11, S/13. Withraw old needle styli by gentle but straight pull and insert new styli without using force in the same manner. Using force would damage pickup mechanism as well as possibly snap off cantilever of stylus. If cartridge is inaccessible for effecting styli change while cartridge is in position, it can easily be removed in all cases by unscrewing cartridge from pickup arm.	12/6
 S/9	Various Acos cartridges. The main difference between S/8 and S/9 is length and angle. As the angle cannot be re-set watch this point carefully. S/9 used by Collaro, Garrard, Acos and others.		12/6
S/10	Goldring Magna cartridge No. 200.		12/6
 S/11	Plessey Changer.		25/-
 S/13	Garrard "Astatic" U.S.		12/6

● **COLOUR CODE:— RED FOR MICROGROOVE: GREEN FOR STANDARD 78.**

These styli cover almost 100% of equipment sold in Australia. Regarding new and off-standard types refer to Goldring Service Department for information and help. All Goldring needle styli are of finest quality and produced to most exacting standards, backed by long experience. Prices kept at lowest economical level. Do not confuse with cheap needles on the market. Insist on genuine Goldring replacement styli.

ALWAYS SPECIFY WHETHER FOR MICROGROOVE OR STANDARD

Use these charts for identification. You can easily change the needle stylus yourself, and save record wear.

TYPE	RECOMMENDED FOR	Instructions for Needle Change.	PRICE
S/14	Garrard Astatic Crystal Pickup	1. Remove worn needle by prising upward with a penknife blade under rear of needle. 2. Insert shank of replacement needle and press down gently at base of shank.	12/6
S/15	Acos GP.33	Withdraw old stylus by straight but gentle pull, and insert new stylus—pressing gently in to the correct depth.	12/6
S/16	For latest imported record changers, and Acos HGP.37	Grip stylus arm immediately above stylus . . . continue lifting operation through 90° . . . pull gently. This will remove stylus from bush. To replace, reverse operation.	12/6
S/17	For Collaro, Ronette, Velvet Action. (Cartridges TO284, TO284)	Remove screw holding old stylus. Replace with new stylus. Tighten screw carefully.	12/6
S/18	For Garrard Crystal Cartridge GC.2 (A.54)	1. Remove worn stylus by prising upward with a penknife blade under rear of stylus 2. Insert shank of replacement stylus and press down gently at base of shank, making sure that the two ears on stylus bar fit over plastic coupling.	12/6
S/19	For Garrard Turnover Magnetic Pickup	With pickup in L.P. position, remove arm. Unscrew and remove stylus plate. Lift bridge piece and stylus assembly off stylus plate. Place new stylus assembly in stylus plate. Refit bridge piece. Replace stylus plate in cartridge—red spot to front. While tightening screws, check that armature is central.	30/-
S/20	Goldring Variable Reluctance Cartridge No. 500.	Withdraw old stylus by straight but gentle pull, and insert new stylus—pressing gently into the correct depth.	12/6
High fidelity pickups with styli as integral part of their construction.	Styli, being an integral part of pickups in this group, cannot be supplied. New styli will be fitted at moderate cost by Goldring Service Department, 57 H.E. Area, ST. MARYS, N.S.W. Please take cartridge to your retailer, who will make necessary arrangements. The best known pickups in this group are the Goldring Headmaster and the Decca magnetic pickup. In the case of the latter it will be sufficient for armature to be sent in to effect styli replacement.		Price on application to Goldring Service Department.

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WHY IT IS IMPORTANT TO CHANGE NEEDLE STYLI REGULARLY

Many record collectors do not know that so-called "permanent" styli, including the sapphire types, need to be regularly replaced. Actually, the word "permanent" has been used in a relative sense—to distinguish such special styli from the older types of steel and fibre needles that played between one and ten records.

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Safeguard your valuable records . . . the cost of regular stylus replacement is negligible in comparison.

DANGER SIGNALS.

Immediate change is indicated if you observe the following:

Standard Records. Black dust accumulating on needle point and increased surface noise.

L.P. Records. Fine thread or fluff at needle point and discoloration of grooves.

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OFF THE RECORD — NEWS & REVIEWS

In plenty of time for Christmas we find real interest in several versions of The Messiah. They are not all yet released here but within a couple of months there will be three or four available.

By JOHN MOYLE

THE task of going through them all on a comparative basis is enough to make the stoutest heart quail, not so much because of the musical ordeal, but because two of the versions have eight sides each, and the others probably six each. That's about 14 hours listening if everything is played and nothing repeated. One has to be very fond of The Messiah not to feel a little dulled after that!

The version I have been playing is by Decca, and I'm prepared to say right now that I doubt whether any of the others is likely to outshine it taken as a whole.

HANDEL—The Messiah. Played by the London Philharmonic Orchestra with the London Philharmonic Choir, Jennifer Vyvyan (soprano), George Maran (tenor), Owen Brannigan (bass), Norma Proctor (contralto), George Malcolm (harpsichord) and Ralph Downes (organ), conducted by Sir Adrian Boult. Decca 2921-4.

This is a complete version, with none of the cuts which are by force required in most concert versions. In fact Decca make quite a point of the fact that the music is as near the original in score and presentation as they could make it.

This is not a mammoth or massive performance such as we often hear in concert halls. Neither the orchestra nor the choir is larger than it need be, or was appropriate in Handel's day.

As a result it loses magnificence in those great choruses, but it gains a clarity in recording which on the whole you will probably prefer. I do not mean that the choir sounds dull, or dead, or spindly. On the contrary it is a very fine collection of picked singers. But it just hasn't quite the amount of weight required to give the fullest impact to the "Glory of the Lord", "Unto Us a Child is Born" and the "Hallelujah Chorus".

The orchestra must come in for solid approval. The conductor has approached the work as music and not just a vehicle for effects. There is full appreciation of its narrative and dramatic significance with a certain reverence as well. The orchestra is with him in fullest flexibility, balanced, certain, and sure.

The soloists are all convincing. They handle their parts with intelligence, and for the most part with remarkably even worth. But with the exception of the contralto, who is very nearly first class, they sometimes fall a little from grace. Both the tenor and the bass, are at times somewhat explosive and lacking in that polish we look for in front rank performers. On the other hand, you will be struck by their complete musical sincerity.

I have very little criticism of the recording as such. The harpsichord balance is very good, there is plenty of space and atmosphere about it all which is just what we require where a choir, organ, orchestra and soloists come together. Frequency range is quite adequate, and although you may have to watch your stylus near some centres, on the whole there are no noticeable flaws.

I think these are four discs which show worthwhile achievement and of which Decca can be proud.

SCHUBERT—Symphony No. 8 in B Minor (Unfinished) played by the Concertgebouw Orchestra conducted by Eugene Jochum, Philips A00604R. Played by the Philadelphia Symphony Orchestra conducted by Bruno Walter, with MOZART'S "Jupiter" Symphony No. 41 in C Major. Columbia 330CX 1082.

The Philips Unfinished is a 10in record, while Columbia's is a 12in containing a symphony on each side.

There is a remarkable similarity between the two versions, and it would be quite easy to switch from one to the other without appreciable differences either in the conductor's ideas or the recording.

The Philips record has somewhat more reverberation, and the soft bass which is quite important in both movements is a little more so than on the Columbia. The latter however, is very clean and clear, and I'd find it hard to pick the better. Philips might just win by a head, but they are both very good musically and technically.

The Jupiter is of the same general standard, but I didn't like the recording quite so well. It lacks something in body and a certain flexibility which others I am sure would give to it. It is an interesting coupling nevertheless and as a stock record it is above the average. Some experiment with extra tone controls improves it.

BEETHOVEN. — Concerto In D Major Opus 61 for Violin and Orchestra. Played by Ruggiero Ricci and the London Philharmonic Orchestra conducted by Sir Adrian Boult. Decca LXT 2750.

I can't rate this recording as more than good stock standard. The violinist I found full of rather unwelcome surprises which, despite some very good playing at times, number many lapses in tone and intonation which shouldn't be there.

This is a big work in every way, and nothing short of a big performance will satisfy me. Somewhere or other there must be a recording on the way which will win the five stars, but I fear it is still in the future.

No recording can get to first base with me which, at the commencement of that lovely melody in the second movement, has an obvious tape join and an appreciable rise in pitch. Surely this must date from Decca's unfortunate early period when such things were allowed to blot their escutcheon.

General balance isn't so bad, but the violin tone is too often thin and ineffective. General recording level is not high, and the surface noise more obvious than is normal.

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LEONCAVALLO.—I Pagliacci, Sung by Richard Tucker (Canio), Lucino Amara (Nedda), Giuseppe Valdango (Tonio), Thomas Hayward (Peppe), Clifford Harvout (Silvio), with the orchestra and chorus of the Metropolitan Opera Association, New York, conducted by Fausto Cleva. Philips A 1102/1103 L.

I praise these records with some reserve, for although they are too good to pass over, there are shortcomings to be found.

Maybe I am particular, but I think this is a fine little opera, near to the earth, and filled with a procession of really good numbers, which will be operatic highlights until the end of time.

But its very drama and consequent demands on the singers underline any weak spots very clearly. The spotlight falls all the time on Canio, the tragic hero who is betrayed and must play the fool with a broken heart. It demands a clear, flexible and strong voice, able to handle the gaiety or tragedy of mood convincingly and easily.

Richard Tucker doesn't do that. He is undoubtedly experienced, but lacks somewhat in both voice and personality. Nedda at times sings charmingly, but except at the final scene, where the composer has helped a great deal, I thought much of the drama and more subtle development of the plot was missing. Her stage laughs need a little practice, I fear.

The orchestra, however, is very good. Its all-important balance is very well maintained, being close enough to be distinct, and far enough away to give the appropriate sense of theatre. The chorus, too, makes few mistakes, although at times, it is too remote — more like a choir than a crowd.

The recording generally is first-rate. The famous prologue gives Valdengo a chance to show his voice, which he does well, even if the final note is only just within his range. His dramatic sense throughout is probably as well proportioned as any.

The surface is very quiet, and can virtually be ignored. Despite my criticisms, it is the best recording of Pagliacci I have heard so far.

CHOPIN.—Sonata in B flat Minor, Opus 35 (Funeral March), Fantasy in F Minor. Opus 49. Polonaise No. 6 in A flat Major. Opus 53 (Heroic). Played by Alexander Uninsky. Philips A 00124 L.

This is a most convincing piece of piano recording. In the first place there is no surface noise at all, neither scratch, nor clicks, nor rustling noises nor nothing. The mike placing is just right—neither crowding the keyboard or so far back as to lose the top register in thin air.

There is a good deal of weight, not only in the pianist's attack, but in the balance of the instrument itself. But at no time is there any sign of stress—it plays as easily and cleanly as anyone could wish.

Whether you like Chopin sonatas is your own business, but there is no doubt about Uninsky's competence. His first movement I thought was in particular first class, and in it the recording shows up best. He doesn't quite know what to make of the strange little final movement, so he scrabbles through it as a kind of a prolonged bravura. Maybe that's all it is.

The two smaller pieces are cast in the same mould. This is good, firm clean Chopin, and I'm all for it, although a little more devil in the Polonaise would have been good, and there are a few uncertain moments.

GUSTAV HOLST—The Planets. Played by the Philharmonic Promenade Orchestra with the London Philharmonic Choir, conducted by Sir Adrian Boult. Nixa NLP 903.

Technically this is the best Nixa record I have heard so far. It is an ideal piece for any orchestra to show its paces, and for that matter the recording engineer as well.

There are seven musical pictures of seven planets—Mars, Venus, Mercury, Jupiter, Saturn, Uranus, and Neptune. Presumably Pluto had not been discovered at the time, and, in any case, it certainly would not have acquired the personality which myth and legend have given to the others.

There have been many discussions as to the musical worth of this suite, if it can be so called, but there can be none about its impact or orchestral interest in this record. It is completely programmatic, depicting each planet in its traditional form—Mars, Bringer of War; Venus, Bringer of Peace, &c.

As an amplifier show piece, it could scarcely be surpassed, containing as it does a welter of instrumental color ranging from some bass which is at times quite colossal to plenty of clean cymbals and high frequencies generally, all in great weight and first-class balance and presence.

The surface, too, is in keeping with the requirements of a "high-fi" disc, being at the worst little more than a rustle.

As vivid and exciting music excellently recorded, I can heartily recommend it. It makes the five stars.

INTERNATIONAL MUSICAL EISTEDDFOD — International Folk Songs and Dances taken direct from the performances under the auspices of the International Music Council (UNESCO). Recorded in Great Britain. Westminster WAL 208-9.

These two records are quite unique in my experience, for they include items by singers, choirs and performers from various parts of Great Britain, Europe, and other countries, including America. These range from three contrasting performances of an old 17th-century Italian madrigal sung by a choir from England, America, and Italy, to obscure folk songs, sword dances and the like. In these we hear an amazing collection of drums, whistles, clicks and clacks, and an equally wide variety of accordions which seem to be used in so many countries.

The whole thing is tied together by a commentary by Jack Barnoff, executive secretary (UNESCO), who introduces each item and supplies explanations and descriptions of the performers, their dress and actions, and the special significance of what they are doing.

This process does something to make up for the lack of television without which I fear many of the items cannot be enjoyed. In fact, the only criticism I have is that there are rather many dances in which we hear some heavy footwork which to some could become tedious.

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I don't know whether these would be records you would play to yourself once a week, but they are without doubt an unusual and valuable musical record. Any student of musical history would find them quite absorbing.

Technically these are typical Westminsters. Some of the unusual "effects" which go with many songs and dances come through most vividly. There is virtually no surface noise.

SAMMARTINI — Concerto Grosso Opus 11 No. 4. PERGOLESI—Trio Sonata with String Orchestra. CORELLI—Concerto Grosso Opus 6 No. 9. Played by the Vienna Symphony Orchestra conducted by Rudolph Moralt. Westminster WL5009.

"The three works here recorded make an excellent illustration from the so-called 'minor' masters of the extent and practice of the concerto grosso as the dominant pre-symphony orchestral medium of the early eighteenth century."

So says Edward Tatnall Canby, whose typically well-written notes adorn the record cover of this first-rate disc, and they aptly sum up what you will hear.

It is quite remarkable how the LP disc has encouraged many people to show interest in the history of the music. This record is a really good example of three most important Italians of their time—not only is the music "quality work", but it is beautifully similar yet contrasted in style.

The Pergolesi is particularly easy to hear, no doubt because of his preoccupation with opera in the pre-Mozart manner, and his down-to-earth music mind. No one could mistake it for the Corelli, which follows, despite its surface similarity.

But the entire record is just what we would expect of the Vienna players, who do this kind of thing so well. The recording is smooth and above average throughout, although at the end of the Corelli there seems to be a variation in level possibly due to a tape join, several of which can be heard from time to time. A little bass re-inforcement I found a good thing. The surface is for the most part quite noiseless.

PROKOFIEFF — Divertimento Opus 43—Sinfonietta Opus 5/48. Played by the Vienna Symphony Orchestra conducted by Henry Swoboda. Westminster WL5031.

Your reaction to these two works will depend largely on your reaction to Prokofieff. Just what he is trying to say won't be immediately obvious to many record collectors, but on the other hand it might be pointed out that his manner of saying it is the most interesting thing. I found the music rather patchy, but it includes some good examples of the composer's musical outlook. Maybe this is due to the fact that all the music was rewritten or recast from other work, and the marks of his experiments are not entirely hidden.

Nevertheless, he is as always, clear and concise in his idiom, and in his determination to avoid the musical cliche without abandoning entirely all idea of formal construction.

The performance is a good one, if at times a little heavier handed than it might have been. Orchestral outline is clear, and the instrumental balance good. Recording is not brilliant but above average.

PROKOFIEFF—Concerto No. 3 in C Major Opus 26. Played by Alexander Uninsky and the Residency-Orchestra (The Hague), conducted by Willem van Otterloo. Philips A00650R.

More Prokofieff, with still more to come, judging by other discs still on my list. But a much better work, I think, than the two minor pieces by Westminster. It is one which brings memories of Kapell, for it demands all the things he had in abundance—power, technique, modern imagination.

Uninsky does a splendid job, I thought, if he hasn't quite the flash in his fingers that Kapell had—but then how many pianists have! And he misses that whip-like gesture with which I think the last movement should end—as it is the music just stops and that's all.

This I think is quite an important concerto, filled with the composer's brilliance, clean - cut ideas and impish irony involving some composers of the past. There is a great deal of really sensitive musicianship here, together with some almost classical melody, which is good enough to make us hope that Prokofieff isn't hiding a smile.

The recording is a little remote, as with many by this orchestra, but it's clean and nicely balanced. What a pity Philips persist with their habit of splitting a movement on the turnover. Even if it can't be avoided, I still don't like it, although the break here is intelligently placed.

KHACHATURIAN — Concerto for Violin and Orchestra. Played by Thomas Magyar and the Vienna Symphony Orchestra conducted by Rudolph Moralt. Philips A00684.

In contrast to Prokofieff, this concerto is virtually classical in both style and tonality, and even in its consistent emotional appeal, it harks back into the last century. The music for the most part is wistful and romantic, with free use of technique and color for both soloist and orchestra.

I have no other recorded performance with which to make comparisons, but Magyar's full tone—free from any suggestion of a thin wail which mars the work of any—his firm bowing and good intonation are admirably suited here. In the recording the violin is rather forward, which makes the orchestra appear to recede more obviously than in fact it does.

Personally, I wouldn't mark this against it, for the music is somewhat ephemeral in the main, and the soloist's part is in character as it is.

Consequently, the recording generally hasn't a big impact, nor extreme range, but I thought it most effective in its balance.

The surface is somewhat better than average, but once again there is a maddening break in the lovely slow movement—this time one I find it hard to pardon. Otherwise this is a record which could easily become one of your favorites—a distinguished performance.

BEETHOVEN—Symphony No. 3 in E Flat Major Opus 55. Played by the Vienna Philharmonic Orchestra, conducted by Wilhelm Furtwangler. HMV ALP 1060.

My only real objection to this record is that I just can't get used to Furtwangler's constant changes in tempo.

To me they are not effective in giving force to music which lends itself far more to variations in dynamics where emphasis, light and shade are required. When one gets a colossal thing like this symphony in full flight, there is a horrible feeling of being over-run by a big trailer when the conductor suddenly pulls up in his tracks.

I do not mean that tempo should never be varied. But it should not be done for obvious effect or it becomes an intrusion and an irritation.

Otherwise, the recording has a good breadth and a clear outline. I liked the degree of reverberation —greater than Karajan's Columbia effort, but less massive and more remote. It wouldn't be at all hard to get quite attached to this record if you don't mind the heavy rein, a broken second movement for a turnover, and a pretty funereal funeral march.

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PUCCINI—La Boheme. Sung by Lucia Albanese, Ann McKnight, Jan Peerce, Francesco Valentino, Nicola Moscona, George Cehanovsky and Salvatore Baccaloni with the NBC Symphony Orchestra conducted by Arturo Toscanini. HMV OALP 108L-2.

Taken from a recorded broadcast of 1946, the performance has all the earmarks of radio. It is a studio job—one can almost visualise the singers grouped round a microphone giving their all, the orchestra carefully playing into another, and the sound men making sure everyone is heard as though they were almost in your lap. They haven't forgotten Toscanini either, for he is heard tonelessly encouraging the singers through some of the best arias.

There is very little of the spacious and youthful romanticism which made the earlier Decca recording so good, and which is quite essential if the opera is to breathe with life. Albanese is not in Tebaldi's class as Musetta, and Jan Peerce might have been her uncle, but never her eager lover.

The orchestra is very forward, and plays quite impeccably. But in Boheme I don't want to be conscious of it in that way.

In brief, this record is well manufactured, and all have labored very hard. But it has no atmosphere, it is a thing in two dimensions. And the recording is no more than good 78 standard.

SAINT-SAENS:—Carnival of Animals, with Noel Coward as narrator of accompanying verses by Ogden Nash. Played by Andre Kostelanetz and Orchestra. Philips N 02602 R.

A disc, which stands or falls on whether you think Ogden Nash as read by Noel Coward is funny or not. Twenty years ago most people did, but today it's not a sure fire combination. On the other hand, it's a free country, and those who do go into convulsions with each witty quip wouldn't be without it for the world.

Because there isn't much else wrong with it if you don't mind recitations mixed up with the music. The recording is very nearly top class, and the performance is nothing if not bright and convincing. On a good machine, for instance, the double-basses doubling for the elephants are as good as you are likely to want.

I think it's reasonable to select music of this character if you want to indulge in some programmatic fooling. As such it is most successful, and if you like it you'll love it.

ORGAN RECITAL by Dr. A. E. Floyd (Music by Bach, Handel, Schumann, Purcell and Wesley). Spotlight SC 1002.

This is a record which will interest many, for not only has Dr. Floyd a long and distinguished career as a musician in Australia, particularly as organist and choirmaster of St. Paul's in Melbourne, but he is well known for his popular radio session from the ABC.

The organ used is in the Melbourne Town Hall.

The most successful side is undoubtedly Side 1, in which we hear a number of smaller pieces. Side 2 commences with Bach's Toccata and Fugue in D Minor in which Dr. Floyd is up against some severe competition in the recording world.

His approach I thought was too fussy, and his general performance too uncertain to make much impression upon it.

None of the smaller pieces, of which there are six in all, are very distinguished, but they are no strangers in the main to anyone familiar with the organ.

The recording in general is quite good, with commendably low background for a recording in such a large hall. The extreme top register drops, but even my own organ records do that! The registration comes through quite cleanly, and the bass is very solid. Surface noise is not up to best standards and shows up on wide range equipment.

But it's a commendable effort by a new Australian company.

MOZART—Quintet in A Major for Clarinet and Strings (K581). Played by Reginald Kell and the Fine Arts Quartet. Brunswick. AXTL1007.

There are many things to like about this record—the music itself first and foremost. Any one of the four movements would be sufficient to carry the work on its own. As it is, we come as near to musical perfection as we are ever likely to in this world.

On the other hand it needs the most complete blend of performers and the most sensitive of musical spirits to catch completely that elusive delicacy and strength which makes it such a lovely thing.

I was disappointed, therefore, to find an undeniable heaviness about this record, which persists from first to last. It gives the impression of being played slowly and carefully, but with little light or vitality.

Maybe I am being super-critical, but several playings of the record have not changed my first impression.

It plays best with a little extra bass—I would have liked a little more body. Otherwise it is nicely done against a quiet background.

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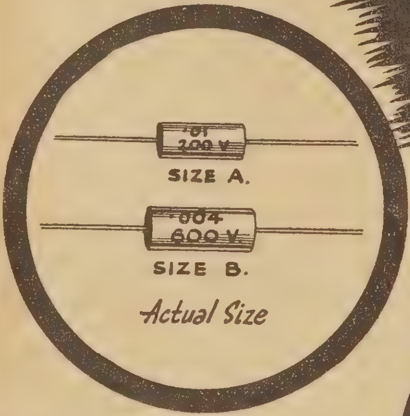

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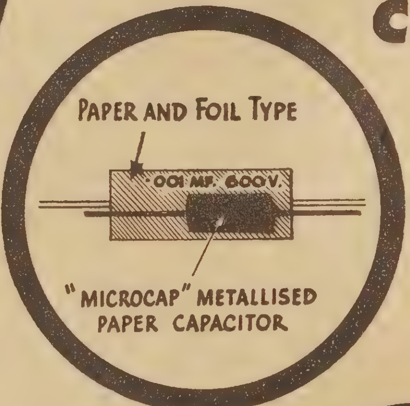

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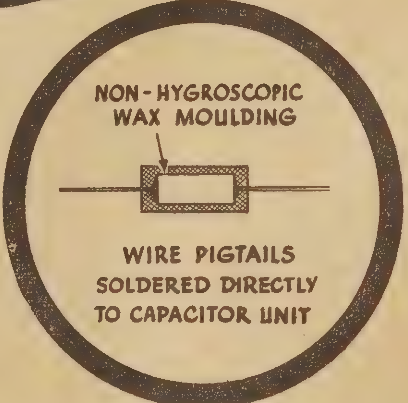

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THE FUTURE OF RECORDED TAPES

As Discobolus has mentioned in his "Record News from Abroad", some big news from overseas concerns the availability on pre-recorded tapes of recordings already released on discs. The announcement is made both by RCA in America, and EMI in London, and among a handful of leaflets received from the recent Radio Show are some dealing with the tapes.

A FEW years ago, just about the time that microgroove records hit the market to be precise, there was considerable discussion as to whether tapes would supplant disc records for home entertainment.

At that time, there seemed no doubt that the disc would remain the world's most popular recording medium. Tape recorders were not common, and their performance wasn't good for music unless highly priced commercial equipment was used.

Since then, however, the consumption of tape recorders by the public has been remarkable. Thousands of them have gone into use in Australia, and it is safe to say that overseas their number would amount to millions.

MANY RECORDERS

One reason why record companies have turned their thoughts to tape is undoubtedly the number of these recorders in use. Just why so many people buy them is hard to imagine. I feel sure that many are used very rarely once the novelty angle has worn off.

If their owners decide to buy the new tapes, they can of course play them through their recorders. The speed used is 7½ inches per second, which is easily the most popular tape speed today.

But looking at the idea from this angle, the prospect doesn't seem very inviting particularly if the listener is a "High-fi" addict. It would be stretching the truth beyond all limits to imagine that more than a small fraction of tape machines is capable of handling the "full frequency range" mentioned by EMI, if this phrase means what it says.

The owner of the tape, even if he uses an auxiliary loud speaker (which I sincerely hope he does) cannot hope to match the performance of a good microgroove disc played through a good amplifier. He certainly won't hear the "full range of frequencies known to the human ear" to quote further from the EMI leaflet. He'll be lucky to hear one-third of them.

HIGH PRICES

What he will get is the same uninterrupted playing he can now realise from discs, without some of the background noise associated with not-so-good discs. He will also avoid some of the end groove distortion occasionally heard from similar not-so good discs, or from worn styli.

It's hard to see what else he will gain and he will, for the time at least, pay from £2/15/- to £4/4/- sterling for his tapes.

At the same time, it is most unlikely that the venture would have been undertaken unless there was some future to it. It may be the recording companies don't imagine that the majority of their customers worry about high fidelity. Maybe they are right there, remembering the low standard of most commercial radiograms. Maybe they imagine that even for a selected market, the cost involved isn't extreme, and they may as well explore every avenue of selling their recordings in a highly competitive field.

Therefore it seems that the idea is an exploratory one, maybe to see whether someone's hunch is good. If it comes off, there isn't much anyone can lose, and it will sell tape as well as recordings.

BROADCASTING INFLUENCE

It is not unlikely, however, that the broadcasting companies have something to do with it. After all, they use tape machines freely, and nearly every station has a high quality job which will give very good response at 7½ inches. And they are quite used to the task of broadcasting programs from tapes.

In this field, the tape is probably better than the disc. Studio announcers working against the clock are a heavy handed bunch and both discs and pickups suffer severely in use.

If the recording companies were persuaded to make recordings for broadcasting available on tape instead of discs, why not make some spares and sell them to anyone who will buy?

What impact will the tapes have on the record field? I would say practically none. The absorption of records is so vast, and the proportion of radiograms to tape machines for the measureable future is likely to be so large that tapes can be considered as extra business.

One thing is sure — it will be a most interesting process to see how many are sold, and what happens to them when they are.

CRYSTAL BALL STUFF

I suppose we all dream about what might have been, and record manufacturers are probably no exception. I'm sure they often stand with their master tape ready for processing and look through two windows.

Through one is an expensive and dirty factory cutting acetate discs, plating them in messy baths, fitting them to heavy presses coupled to steam boilers and cold water, worrying about pressures and mixers and stampers wearing out and discs being spoiled. And the care with which they must be handled to avoid warping and damage.

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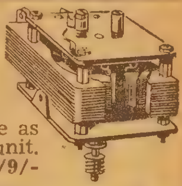

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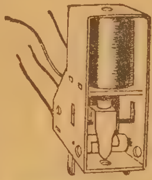

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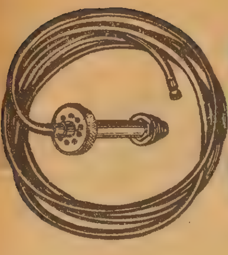

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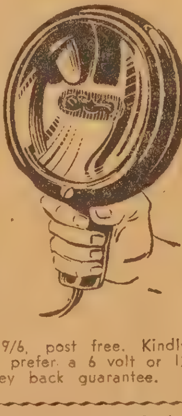

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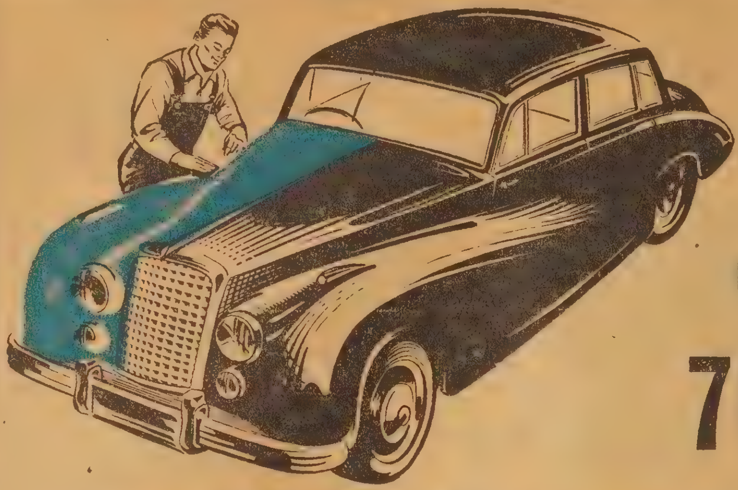

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RECORD NEWS FROM ABROAD

By DISCOBOLUS

The Radio Show held in London at this time each year is always notable for the vast array of new equipment shown to the public for the first time, and the show just concluded has been no exception.

FOR the audio enthusiast in particular, there will be plenty to choose from in the next few months, with new pick-ups, and records literally by the score, in all sizes and speeds.

Perhaps the most interesting, and—to me—most surprising new development is the news that, commencing September 3 HMV are selling over the counter tape recordings of some of the music they already have in their LP catalogues. This news comes only a few weeks after the announcement mentioned last month concerning the issue of tapes from RCA Victor in America. As with the new RCA tapes, HMV are issued at 7½in/sec., and they are available in four price groups, which are arranged in the same basic divisions as for the discs. All are twin-track, and they play for either 60 or 40 minutes, depending on the musical content.

FIRST ISSUES

The first list consists of the following tapes: Schumann Symphony No. 4, Tchaikovsky No. 6 (both with Cantelli), the Dvorak No. 4 (Kubelik), Beethoven Concertos Nos. 2 and 4 (Solomon, both on the same tape), Mendelssohn Violin Concerto and two Beethoven Romances (Menuhin, also all on one tape), Schubert Symphonies Nos. 4 and 5 (London Mozart Players one tape), Carnaval and Sylphides, Ballet Music (Robert Irving and Royal Opera House Orchestra, one tape), and, on the lighter side, ten numbers by the Melachrino Strings and about the same number from Joe Loss and his orchestra. Prices vary from 84/- down to 55/-, which is about two and a half times the price of the same music on LP discs. Incidentally, a "blank" EMI tape is 35/- in England, and the customer still has a usable tape even if the recording is erased. Some day in the future it will probably be possible to have the tapes reloaded with new items for a fee, but perhaps this is looking too far ahead just now.

QUALITY

It would be foolish to suppose that the quality of these commercial tape recordings would be identical with that of the HMV original master tape, but the loss in speed-transfer to 7½in/sec could scarcely be greater than the loss between master tape and commercial LP disc. Moreover, no background noise would be evident, and no clicks or pops would ever mar the surface with normal use. In this respect, tapes very definitely have something to offer, and if played on a machine which has had as much design work put into it as the average audio enthusiast's record-playing equipment, then I would hazard a guess that results would be more than acceptable. I hope to be able to say next month how well or how badly they have been accepted into the scheme of things in England. HMV must be confident that there is already a sufficient market for them, and I draw the inference that tape recorders are being used quite extensively in the home for entertainment.

NEW RECORDS

HMV first, with a complete Faust from Paris, Brahms No. 3, Don Juan, and Siegfried's Rhine Journey with Toscanini, nine Mozart Overtures from Kubelik, a new Swan Lake, Mozart No. 39, and Haydn's 95 with the Glyndebourne Festival Orchestra, the Berlioz Fantastique from the San Francisco Orchestra and Monteux, and another nine LP's of piano and chamber music, as well as 25 new EP 45's.

Columbia also have over 20 45's, all new, Bellini's opera Norma from Milan, plus four symphonies, eight concertos, and sixteen orchestral and solo items, briefly as follows: Beethoven No. 1, with Karajan, Galliera's New World, Elgar's Bavarian Dances and other items, Rachmaninoff's Concerto No. 2 (Galliera and Geza Anda, a new pianist for EMI, but already available on the Angel label in USA), Mozart Concerto No. 27 (Denis Matthews), and a number of others of Vivaldi, while Gieseking has finished Mozart, Vol 3.

SIBELIUS SYMPHONIES

Decca and Anthony Collins have now recorded the Sibelius Symphonies 3, 4, and 7, and their September release includes the following: Mozart No. 25 and 38 (Georg Solti), Beethoven Concerto No. 4 (Curzon and Vienna Phil), the Brahms Violin Concerto, four Bach Sonatas and two Partitas, four Beethoven Sonatas, some Brahms piano from Wilhelm Kempff, and Faure Ballade and Concertino, with Kathleen Long. The major work from Decca is Der Rosenkavalier, with the Vienna State Opera Chorus and the Vienna Phil under Erich Kleiber. Hilde Gueden, Sena Jurinac, Ludwig Weber, and Anton Dermota, are the principal soloists.

Parlophone have just issued Haydn's Mass in Time of War, from the Haydn Society recording, and some light Mozart with the London Baroque Ensemble, with orchestral items of Rimsky-Korsakov, Tchaikovsky, and Ippolitov-Ivanov.

NIXA are well to the fore once again with 15 new LP's of serious music and 16 in lighter vein, while Monarch records, a rank outsider in England, is releasing late in September a number of discs of Russian origin, including Tchaikovsky Symphony No. 1, the Symphonic Poem Thamar, by Balakirev, two suites from Prokofiev's Romeo and Juliet, a complete version of Rimsky-Korsakov's opera Sadko, his Trio in C Minor, the Symphony No. 1 of Shostakovitch, and Brahms' Violin Concerto featuring David Oistrakh.

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SHORT-WAVE NOTES BY ART CUSHEN

N.H.K. OPERATES TWO DOMESTIC NETWORKS

The First and Second Network of the Broadcasting Corporation of Japan, which are relayed on short-wave provide fair signals at present.

SOMEWHAT overshadowed by the new Radio Japan, using 50Kw, the domestic relays of NHK (Nippon Hoso Kyokai), the Broadcasting Corporation of Japan, is still in operation.

Japan's two networks, the first network, which operates to 12.30 am each day, relays from the key station JOAK (Tokio), while the second network closing at 12.10 am relays from the key station JOAB (Tokio) and from the announcements of these key stations, listeners will be able to identify the network being relayed.

The two networks give a coverage on broadcast band of 98 pc for the first, and 86 pc for the second, while the short-wave relays help to further cover the areas which the broadcast band stations do not penetrate.

More than 9½-million listeners are subscribers to the radio service, and the fee is about 15/- per year.

A big-scale scientific listening research organisation is maintained so that the wishes of the nation in the radio field are known, and some 3-million letters are handled annually on this matter.

SHORT WAVE SERVICE

The short-wave service is carried on 5 Kw transmitters located at Nazaki and Kawachi. The first network programs are broadcast on JKI (4910), JKH (7257), JKI2 (9655), and the second network on JKM (4940), JKJ (7285) and JKM2 (9695). Special broadcasts for overseas listeners are carried on 7½ and 5 Kw transmitters, JBD (9505), JBD2 (9560), JBD3 (15,225), JBD4 (15,235).

Schedules are:

JKH (7257) 6.30 am-8.00 pm.
JKI (4910) 6.00-8.15 am, 8.00 pm-12.30 am.
JKJ (7285) 6.00 am-8.00 pm.
JKI2 (9665) 8.25 am-8.00 pm.
JBD3 (15,225) 1.00-2.00 pm.
JKM (4940) 8.00 pm-12.10 am.

NOTES for the next issue close at 212 Earn Street, Invercargill on October 9th, 1954. All times are Australian Eastern Standard Time.

THE VOICE OF THE UN COMMAND

LAST month we reported hearing this station, operating on 4780 Kc at 5.00 am, and since then further checks on the broadcasts have enabled us to learn further about this interesting station.

The broadcasts appear to commence at 12.30 am, when at that hour the three broadcast band stations of the Broadcasting Corporation of Japan, JOAB (Tokio), JOBB (Osaka) and JOGB (Kumamoto). Best reception of the UN short-wave station is at 5.30 am, when the announcement, "This is VUNC. This is the Voice of United Nations Command" is given.

The station does not appear to have a callsign, as we first thought, but the initials of the slogan are used as part of the identification. Reception reports have been sent to the UN representative in Tokio, and three years ago, when UN Command was operating, reports to the Broadcasting Corporation of Japan were not verified, as they only loaned the transmitters to UN.

BETTER NIGHT SIGNALS

OCTOBER is the time when most overseas broadcasting organisations which beam transmissions to Australia and New Zealand switch from afternoon and early evening transmissions, to ones later at night, as we find the summer months provide much better reception of signals from Europe after dark. At the same time transmissions are shifted to the 25, 19 and 16 metre bands, which become very active with signals from all parts of the world.

The main changes will be noted from Hilversum, which during the winter covers this area with a broadcast in the afternoons. The popular "Happy Station" program heard on Sundays at 8.30 pm will again be a regular favorite with listeners to Hilversum, Brussels, London, Rome, Ankara, Stockholm, Helsinki, Berne, Cairo and many others will again provide entertainment signals on 19 and 16 metres from 8 pm onwards.

Radio France Asie in Saigon, will again provide excellent signals on 15,430 Kc and many listeners will be tuned to the popular Letter Box and request programs on Friday evenings at 7.30 pm Brussels has a DX session on 15,330 17,860 Kc on Wednesday at 8.10 pm.

SCHEDULE FROM CAIRO

The latest schedule of Egyptian State Broadcasting, Cairo, released over Radio Australia, will help listeners identify the many Arabic broadcasts they hear on short-wave, and which remain unidentified. Best afternoon reception, is during the Arabic transmission on 12,020, 7050 Kc, 2.24-5.00 pm (Fridays 2.55-8.25 pm) 10,00-11,00 pm (Friday 9.30-11.00 pm), 1.00-2.30 am, 3.00-7.00 am. Hebrew broadcasts at 11.00-11.15 pm, Turkish 12.30-1.00 am, Swahili 2.30-3.00 am. The Far East service on 17,725 Kc is broadcast 8.56 pm-12.15 am, English 11.00-11.30 pm

The Far Eastern service also includes Persian, Indonesian, Arabic and Urdu 8.56 pm-9.45 pm (Persian), 9.45-10.30 pm (Indonesian, 10.30-11.00 pm (Arabic), 11.30 pm-12.15 am (Urdu). The European service on 9470 Kc, 4.20-7.00 am, on Sunday and Monday sign off is 8.00 am. French is broadcast Monday, Thursday, Saturday 5.00 am to close, and in English, Tuesday Wednesday, Friday, Sunday from 5.00 am to close down. A further Arabic transmission is broadcast on 9750 Kc 3.00-9.00 am, but the broadcasts now close earlier than scheduled. A service for North American listeners is being planned.

COLOMBIA's Radio Liberator located in Medellin, which we reported in this page some months ago, as being heard in New Zealand at 1 pm, has now verified a Swedish DXer. The short-wave callsign is given as HJDY and the frequency 5980 kilocycles. This station relays HJDO on broadcast band.

LUXEMBOURG's short-wave transmissions, which are not often reported, are at present being heard mixed with VLI6 Sydney at 4.00 pm. The full schedule is 4.00 pm to 9.00 am. The program is in French while on Sundays news is broadcast at 4.00 pm, and at 4.45 pm on weekdays.

FLASHES FROM EVERYWHERE

RAROTONGA, Cook Islands, which we reported in last issue, is now operating on a more official basis, and the callsign ZL1ZA has been allocated. The transmissions are now under the Radio Department, Cook Island Administration, and the programs are provided by the Cook Island Further Education Department.

Transmissions are now on 6180 Kc and this frequency may be altered at any time, and the broadcasts are on an experimental basis, and a permanent frequency which will give reliable day and night coverage over the islands which cover 700 miles, has not yet been found. Most of the program material is recorded and broadcast by the station at an hour when the transmitter is not in use for usual Morse communication work, so that the schedule is also likely to be unstable. There is no special studio buildings at present, reports Jim Shortall, Auckland.

FIJI — Increased schedules on VRH4 the short-wave station of the Fiji Broadcasting Commission, have added both to the sign on and sign off time of the station. VRH4 now opens transmissions on 3980 Kc at 4.30 am Monday to Saturday, while on Sunday sign on is at 6.00 am. The station closes at 9.00 on Saturdays, and at 8.30 pm on other days.

The station expects the broadcasts to be continuous from sign on to sign off but at present two short breaks occur in the transmission. In some details about the listeners in Fiji Mr. K. G. Collins remarks that VRH4 has some 12,000 receivers tuned to the broadcasts, though at present there are only 3000 licences. The Postmaster-General estimate is 12,000 receivers, and legislation is now being introduced to make radio licences compulsory.

Broadcasts from Suva are carried in Fijian, English and Hindustani, and commercial announcements are broadcast in these three languages.

SOUTH KOREA'S new 100,000W short-wave transmitter, together with two on broadcast band, are expected to be operating by the end of 1954, reports Radio Australia. Frequencies have not yet been assigned, but at present Seoul is using 2510 Kc and 7935 Kc. Sehedule is 1.00-2.45 pm, 7.00-1.30 am, 6.30-9.30 am. Broadcasts of news in English are presented 8.30-8.45 pm on weekdays, while English lessons are presented 10.45-11.15 pm, and 7.45 am daily except Sundays.

NORTH BORNEO which has a transmitter at Jesselton, on 7237 Kc, 250W has plans to add a 5000W to 7500W transmitter, and a 16-element array, by the end of the year. Transmissions will be extended, but will not exceed six hours ddily. Slogan is Radio Sabah.

BRITISH GUIANA's Radio Demara located in Georgetown, which we have heard in the spring in recent years is now using a new schedule, which should make reception possible in Australia. World Radio Handbook reports the schedule on 5981 Kc at 7.45 pm-5.45 am, and on 3255 Kc at 5.45 am-12.15 pm. Both transmitters use 2000W and the reception at 7.45 pm should be possible again this summer. Programs are all in English and a news broadcast is given at 9.15 pm.

LONELY LEEWARD ISLAND is the latest country to operate a short-wave service, though the power is very low, only 50 watts. Transmissions are 3255 Kc and the station's slogan is Radio Montserrat, Plymouth, Leeward Islands. Broadcasts are 2.30-3.00 am, 6.00-6.30 am Sundays, comprising religious, news and music, and a schools broadcast on Wednesday at 4.00-4.30 am. The address is Box 201, Plymouth.

THE HAM BANDS WITH BILL MOORE

Amateurs throughout the Commonwealth were very active in the Remembrance Day Contest. Renewing many service friendships they exchanged greetings with interstate amateurs who they would only meet annually in this event.

THE 1954 Remembrance Day Contest was extremely well supported and more stations seemed to be active than ever before. Australian amateurs responded to the spirit of the event, and paid homage to those of their number who passed on during World War II.

Some record scores should be aggregated judging from a survey of the comment heard on the air after the completion of the event.

It would appear that the 1000 mark may be reached in an individual tally, several scores in various States were listed as in excess of 900 points.

If some of the comment was not intended to mislead the inquisitive, stations would have completed nearly 400 contacts in some cases.

Participants who operated through, or nearly through, the 24 hour contest period must be congratulated as the going was really tough at times.

QRM reached high levels especially on the 3.5 Mc band on the Saturday evening. That band provided good contacts, 7 and 14 Mc/s were the bands used mainly during the day and propagation conditions on both were excellent.

The 21 and 28 Mc bands did not open here, and no contacts were reported.

The Macquarie Island gang provided DX interest with VKIAC and VKIDJ very active.

CW operation was restricted compared with previous years and is gradually dropping back in favor in the event.

Incidentally there were some very poor CW signals about especially on the 3.5 Mc band, chirpy and often worse than T8. It would have been difficult to be critical of the quality of telephony signals in many cases, they were just jammed together.

The static level was low and assisted contestants and some State Divisions had teams well organised. Leading stations in Western and South Australia scored well and either of these States could easily win the trophy.

The contest is a teams' event and the RD Trophy is held for 12 months by the winning State Division.

The result depends on the average scores of the six leading stations adjusted in accordance with the total activity in the State concerned.

A general review still points to the fact that, under current rules, it is practically impossible for either VK2 or VK3 to win the trophy. The only hope is for the smaller States not to enter stations seriously.

Since the inception of the contest leading stations in VK2 and VK3 have recorded some good scores.

The adjustment by the multiplier has always ruled against the larger States. To win an RD Contest it is necessary to organise a large number of competitors within a State and see their logs are submitted.

It is much easier to round up 75 logs from a small State than 500 from a large State to ensure a similar multiplier — it is impossible to fulfil the latter requirement.

In recent years some of the leading competitors in NSW have dropped out from serious activity in this contest.

After a number of years' strenuous participation in the contest in an endeavor to win the trophy for the home State they appreciated that the rule adjusting scores in terms of station activity was too great a handicap to overcome. They still enter to assist but restrict their activity to normal hours.

RULES FOR THE VK-ZL DX CONTEST

The annual VK-ZL DX contest will be conducted on the first two weekends in October. The event, a combined effort of the New Zealand and Australian National Societies, the NZART, and WIA, provides stations in the Antipodes with an opportunity to contact others throughout the world.

Despite the current poor propagation conditions, some good DX contacts should be made, providing suitable operating periods are selected for each band.

The following is a summary of the main rules published in their entirety in "Amateur Radio" and "Break In."

Phone Section: 24 hours from 1000 Hrs GMT Saturday October 2 to 1000 Hrs. GMT Sunday October 3. CW section from 1000 Hrs. GMT Saturday October 9 to 1000 Hrs. GMT on Sunday October 10.

All Amateur frequency bands may be used but no cross-band operation is permitted.

Only one contact per band is permitted with any one station for contest purposes.

Before points may be claimed for a contact serial numbers must be exchanged.

Made up of five figures for phone, and six figures for CW; it comprises the RS or RST report plus three figures which may begin with any number between 001 and 100 for the first contact and increase by one for each successive contact.

Scoring for VK and ZL stations:- Fifteen points will be scored for the first contact on a specific band with any overseas country; fourteen points will be scored for the second contact on the same band with the same country; thirteen points for the third and so on until the fifteenth contact will score one point. All contacts with that particular country on that band will thereafter count one point each.

The scoring procedure will be repeated on each band. No VK-ZL contacts are permitted. Official ARRL countries list will be used and each call area in the US will be a "country" for scoring purposes.

Logs must show in this order: Date, Time in GMT, band of operation, call of station worked, serial number sent, serial number received.

A separate log must be submitted for each band and a summary sheet giving station details must be supplied.

A declaration that contest rules and regulations for amateur radio have been observed must also be forwarded with the log.

The NZART will award attractive certificates to the top scorer on each band and the top scorer in each VK & ZL District.

The NZART is conducting this year's contests and entries should be posted to the NZART Contest Manager, Box 469, Wellington, New Zealand, to arrive no later than January 21, 1955.

OPERATING SURVEY

A survey of amateur station activity in the US was taken some years ago. It revealed some interesting points. It is considered that the information then gained still holds except for an average power increase.

The DX man uses an average power of 500 watts and operates 31.5 hours a week. The traffic man uses 375 watts and operates 50.5 hours a week. The "Rag-chewer" operates 150 watts and 18 hours a week. The experimenter uses 140 watts and operates only 14 hours a week.

The figures were obtained after a check on the activity of some 13,000 amateurs. The traffic man and DX man would still spend most time on the air, although the latter may have dropped some operating with the sunspot minimum. The original survey was made during good DX propagation conditions.

N.S.W. DIVISION FIELD DAY ON 144Mc

The full arrangements for the Six Hour Day weekend 144Mc Field Day to be conducted by the NSW Division's VHF section provide an opportunity for activity on this band throughout much of Eastern Australia.

The country section of the net in NSW is to be organised by Hugo Stitt, VK2WH, of Forbes, who was co-opted by the VHF committee.

The Victorian VHF section are fully co-operating and are conducting a field day on the Sunday. During late August the late secretary of the NSW section, Cess Cronin and Steve Adams, VK2YR, journeyed throughout southern NSW and Victoria and did much work in building up support for the day. On their return they will travel back to Mt. Canabalas near Orange to operate on the Sunday.

STATION LOCATIONS

The final location of all stations at this stage has not been decided.

Some stations in the field will include John Miller, VK2ANF, Mt. York, and Cliff Lamb, VK2LG, Mt. Tomah, both in the Blue Mountains. Horry Lapthorne, VK2HL, Harry Solomons, VK2AJZ, Vic Cole, VK2VL, Quinlan Tower, near Morriset. Out from Tumut will be Geoff Page, VK2BQ, Ross Weeden, VK2PN, and Keith Dodd, VK2ZAA, Bob Winch, VK2OA, Mt. Grey, Goulburn, and Keith Alcock, VK2AOA, and Ray Hancock, VK2YM, Canberra.

Many other amateurs will be in the field and some amateurs will operate from their home QTH.

It is hoped to originate a message in Sydney, relay it to the north then back to the Blue Mountains and through the western and southern portion of NSW on to Victoria, South Australia and Tasmania.

COUNTRY SUPPORT

VK2AJO Coolamon, VK2WH Forbes, VK2TA and VK2TC Young, VK2GU Canberra, will provide important links in the net.

There are several possible routes into Victoria on 144 Mc. One to VK3ATN, of Birchip, would allow a further link to VK5BC, of Renmark, and then on to Adelaide. Other Victorian stations give chances of a contact with Tasmanian stations.

Most stations in the field will use equipment allowing them to hold contacts on the 40 and 80 metre bands and check on 144Mc links. Listening on these bands should give some idea of how the day is progressing.

AMERICAN SUCCESS

The VHF gang are very enthusiastic and it is certain that the results obtained will be well worth the effort expended. Good propagation conditions would assist the participants and all hope they will be experienced.

It is interesting to note that the W's at the end of May were successful in transmitting a message on 144Mc both ways across the American continent. They were unsuccessful on their attempt on the previous weekend.

The message only reached W5 in the first attempt, but exchanged greetings from east to west and vice-versa on the second net operations.

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.003	Mica		9d	7/-
.005	Mica		1/-	10/-
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.01	Mica		1/3	12/-
.01	Tubular	1000 Wkg	1/3	12/-
.0002	Mica	1500 Wkg	8d	6/-
.004		1500 Wkg	8d	6/-
.1+.1+.01	Star Paper Tubular	2250 Test	1/-	9/-
.02	Block Mica	300 Wkg	1/-	9/-
.1+.1	Block Paper	1500 Test	1/3	12/-
.1+.1	Block Paper	7000 DC	4/6	48/-
.05	Block Paper	16000 DC	4/9	50/-
.15+.15	Block Paper	8000 DC	4/9	50/-
.25	Block Paper	3000V Wkg	3/-	30/-
2	Electrolytic	500V Wkg	1/-	10/-
50	Electrolytic	12V Wkg	6d	4/6
1	Block Paper	500V Wkg	1/3	12/-
1	Block Paper	800V Test	1/3	12/-
8x8x8	Electrolytic	450 P.V.	3/-	30/-
500	Electrolytic	15 Wkg	9d	7/6
30	Block Electrolytic	100 Wkg	2/-	21/-
.5	Block Oil Filled	8000 Test	4/6	48/-
.1	Block Paper	800 Test	9d	7/6
.5	Block Paper	2000 Test	1/9	18/-
.5	Block Paper	500 Wkg	1/-	10/-
.1	Block Paper	2000 Wkg	3/-	30/-
1	Block Paper	1500 Wkg	5/9	60/-
4	Block Paper	600 Wkg	7/6	72/-
1 mfd	Car Radio Suppressor Condensers		2/6	24/-
455 KC	Padder Condensers adjustable		1/-	10/-

SPECIALS

1. **7-inch electrodynamic loudspeakers** with 1500 ohm field and transformer attached. Worth £2/10/-. **Our price 25/- each.**
2. **I.F. Transformers.** Brand new and boxed, latest iron core type.
   175 KC **4/- each.**
   1900 KC **4/- each.**
3. **Oscillator Coils** shielded in metal can. 455 KC 2/-.
4. **Polished 8-inch speaker baffles** ideal for P.A. systems. Worth 25/-. **Our price 15/-.**
5. **6-inch speaker cones,** suit Rola, Kingsley, Magnavox Cadet Speakers. Price less voice coil **1/6 each.**
6. **Field coils** as used in Rola K8 Speakers, 2000 ohms impedance. Each coil contains over 1lb 30 gauge B & S enamelled wire. Worth 15/-. **Our price 4/6.**
7. **Aerial Wire** for outdoor use, waterproof and insulated.
   50ft coil **2/9.**
   100ft coil **5/-.**
8. **Egg Insulators** for outdoor aerials, porcelain or plastic **6d ea.**
9. **Cathode Ray Indicators type AI.** A few only left. Each unit has 1—5BPI valve with MU metal shield, 6—6AC7 valves (1852), 3—6H6 valves, 12 potentiometers, 10—Block condensers, 40—1 watt IRC Resistors, 1—3 Pos 2 bank switch, 1—toggle switch in all metal cabinet. Price only **£8/10/- each.**
10. **Germanium Diodes** make excellent fixed crystal detectors high output assured, brand new **4/11 ea.**
11. **Condensers.** Metal cased tubular paper condensers, brand new, well known make.

Capacity mfd	Wkg volts	Price ea.	Price per doz.
.002	600	6d	4/6
.005	600	7d	5/-
.01	2000	1/3	12/-
.02	600	9d	7/6
.05	200	10d	8/-
.1	200	10d	8/-
.1	400	1/-	10/-
.1	600	1/3	12/-
.35	200	1/2	11/-
.5	200	1/3	12/-
.5	400	1/6	15/-

12. Carbon Microphones with switch in bakelite case. **5/6 ea.**

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.

547 ELIZABETH ST., MELBOURNE ALSO AT — ALBURY ARARAT BAIRNSDALE BALLARAT BENALLA BENDIGO BROKEN HILL COLAC DANDENONG ECHUCA SALE FRANKSTON GEELONG MILDURA SHEPPARTON ST. ARNAUD WAGGA WANGARATTA WARRAGUL

FUTURE CONDITIONS

Perhaps the most debated question in amateur radio at the moment is just when the HF bands will again provide some around the clock DX.

The lack of signals coincides with the low sunspot activity. The cycle's minimum should be reached about the end of the year and from then on some improvement in propagation conditions should be experienced.

From a radio viewpoint it is difficult to judge from past experience how quickly the bands will improve, especially 14 and 21 Mc/s.

The last sunspot minimum was in 1944 during the war, and amateurs in general were not in a position to judge its effect on amateur band propagation. The previous minimum was in 1933, and at that period most of the DX operation was conducted on the 7Mc band.

The 14 and 28Mc bands really did not receive much attention until a few years later, in fact when sunspot activity increased.

The current 14 Mc band conditions were experienced in 1933. A more or less daily opening occurred to Europe around 2300 hours and to America in the afternoon.

We have no radio yardstick to judge how quickly conditions will improve but scientists state that sunspot activity increases rapidly after a minimum. The rate of increase is much greater than the rate of fall approaching the minimum.

It appears a reasonably rapid improvement in propagation conditions may be enjoyed. Some amateurs even consider that 1954 is showing better openings on 21 and 28 bands than 1953. The 28 Mc band provided some good contacts between the US and Europe, the first reliable work for a number of years.

Improvement on the HF bands means a falling off in DX on 80 and 160 metres, and overseas stations will lose the chance of a WAC on the latter band.

The anticipated change is anxiously awaited so the thrill of some real DX at any time day or night can be experienced.

The 21 Mc band should provide plenty of DX interest, and 28 Mc become the main daytime DX band. Everyone hopes 1955 will show an improvement. It should if the sunspots behave as in the past.

ANNUAL SHOW

The naval authorities operated VK2ZAN from the Sydney Showground during the last Easter Show and provided good publicity for amateur radio. During the Trafalgar Day celebrations in October they will again operate an amateur station, this time from the Garden Island (Sydney) base. Amateurs are requested to listen out and contact the station.

The South-Western Zone NSW Division will hold their annual convention at Tumut over the weekend October 30 and 31. A full program including many field events has been arranged and all amateurs are invited to attend.

Full program details will be given over VK2WI and bookings can be made with the zone officer Jim Edge, VK2ALO, of Coolamon, or with VK2PN and VK2BQ of Tumut.

Tasmanian amateurs placed the hobby in the public view when VK7CF and others operated official WIA station VK7WI from the Queenstown Exhibition during August. Their 36 watts were responsible for a good signal around Australia on the 80 metre band.

14 Mc operators are having quite a time trying to judge whether the band will open to Europe around 2300 hours. No infallible theory has yet been devised to pick an opening. However, quite a number of excellent break-throughs did occur.

It is interesting to note that in May of this year the ARRL issued their 2500th DX Century Club certificate postwar. The recipient W2SAW.

The first DXCC certificate was issued prewar to W8CRA and postwar the first was won by WIFH.

DX on 80 was restricted to W's during August the most consistent being AI. W7MSB. KG6GX Guam and JAICA Japan provided a little interest, both stations peaking around 2100 hours. W2PEO is on each night at the same time, 3515 Kc/s, and is anxious to contact Australian stations.

HIGHER POWER

At the moment there is considerable support for an increase of power among NSW amateurs. The exact terms of any request to the PMG's Department would be a matter of much debate as some support small increases only and on selected bands. Previous moves by NSW through the Federal Convention received little support from other State divisions.

It appears that the NSW division will again move on the subject.

To bring holders of the Limited AOCP certificate into line with AOCP holders in the WIA a notice of motion was tabled by Bob Winch, VK2OA, to the effect that Limited AOCP holders be admitted to full membership of the WIA.

The Christmas party of the Hunter Branch of the WIA will be held on December 4, the venue, The Charlestown Institute. Full details will be given over VK2WI.

Dr. Bob Black, VK2QZ, lectured at the September meeting of the VHF section of the NSW division covering a stable oscillator with variable frequency qualifications and suitable for use on the 144 Mc band.

BEAR BRAND TAPE IS BEST VALUE

YOU GET 20 EXTRA INCHES IN THE ½" ROLL!

SEAL LUNCH WRAPS
COVER ROUGH EDGES
SEAL PERFUME BOTTLES
AND THE PRICE IS STILL THE SAME AT 1/9d.
BEAR BRAND CELLULOSE TAPE

It's the size your shopkeeper uses himself. In addition, because it's made here for Australian conditions, "BEAR TAPE" seals better, mends better, holds faster. "BEAR TAPE" ½" x 200" rolls, in coloured plastic dispensers, cost only 1/9 each everywhere. It's the best tape buy in Australia.

BEHR-MANNING, makers of the famous "BEAR TAPE," are also the largest manufacturers in the Southern Hemisphere of high-quality Sandpapers, Pressure-sensitive Tapes, Adhesives and Coatings, as well as being makers of "PROOFKOTE."

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512 Elizabeth St., Melbourne, C.I.

'Phone: FJ5904. Just 4 doors

Mail Orders Carefully Packed

Please add Freight or Postage

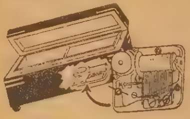
Brand new American Wobble Pump, semi-rotary

PHOSPHOR BRONZE VANES

Continuous flow, £3/19/6.

Ideal for caravans, emptying or filling petrol tanks, watertanks, etc.

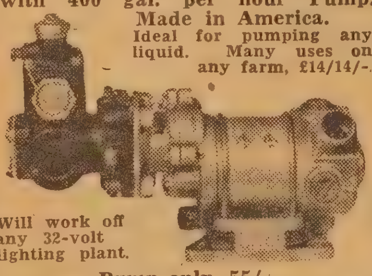
Now you can make your own music box with these Swiss music units. They can be fitted to any type of box, doll, jug, teddy bears, etc. Hours of enjoyment for all the family.



30/- EACH

Tunes available: Lili Marlene, Jingle Bells, Blue Danube, Harry Lime Theme, Wedding March, The Merry Widow, Happy Birthday, Annie Laurie, How Dry We Are, Roll Out The Barrel. Silent Night, Teddy Bears' Picnic.

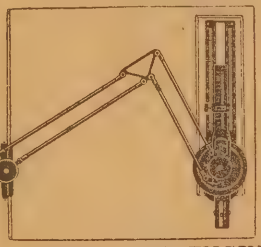
Aircraft 24 volt Motor complete with 400 gal. per hour Pump. Made in America. Ideal for pumping any liquid. Many uses on any farm, £14/14/-.



Will work off any 32-volt lighting plant.

Pump only, 55/-.

R.A.F. PLOTTING BOARD WITH ARM

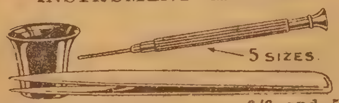


Bakelite Base. Draws Angles Parallel or Vertical.

70/-

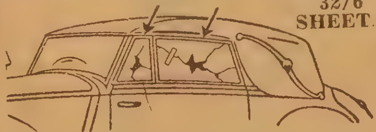
IDEAL FOR ENGINEERS, STUDENTS, ETC.

WATCHMAKERS AND INSTRUMENT MAKERS



English Tweezers 6/6 and 5/6
Eyeglasses 6/6 and 8/6
Extra strong Double Lens Eyeglasses 15/-
Screwdrivers, set of five 13/9

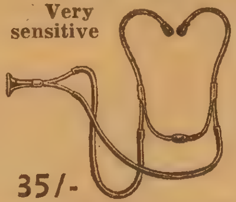
Replace those broken side curtains with cellulose acetate which takes the place of celluloid and lasts four times longer. Will not discolor. 32/6 SHEET.



Non-inflammable acetate sheet is recommended for all types of side curtains. Sheets are 20 thousandths of 1 inch thick. Size of sheet, 24in x 52in. Can be sewn or cemented into frames.

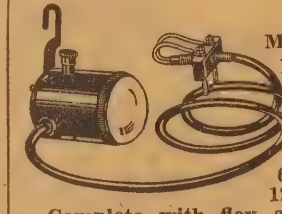
MECHANICS' STETHOSCOPES
Ideal for Testing Engines, etc.

Very sensitive



35/-

MOTORISTS' CLIP ON TROUBLE LIGHT

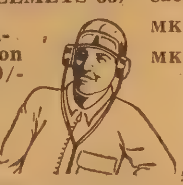


MAGNIFIED BULLSEYE LENS

6 Volt 7/6, 12 volt 6/6.

Complete with flex and plug.

R.A.F. LEATHER FLYING HELMETS 35/- each



Intercommunication Tubes 50/-

PHONES 12/6

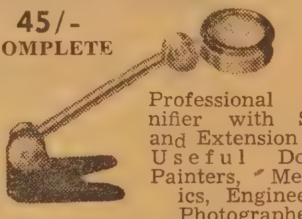
Polaroid Goggles 48/6

MK8 Goggles, 48/6 PR.
MK7 Goggles, 37/6.

WOOL LINED FLYING BOOTS £5/15/- pr.

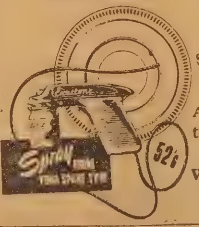
Genuine RAAF outer Waterproof Suits £7/15/. All sizes.

45/- COMPLETE



Professional Magnifier with Stand and Extension Arm. Useful Doctors, Painters, Mechanics, Engineers, Photographers.

SPRAY YOUR CAR, TOYS, HOBBIES, FURNITURE


Spray from your Spare Tyre
52/6

52/6

Spray from your Spare Tyre.

An Ideal Tool for touching up damaged paintwork. Will spray Lacquer, Paint, Enamel.

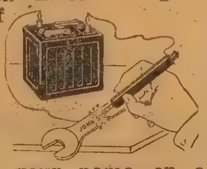
BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

59/6

Ideal for all types of Trucks, Tractors or Cars. 7500lb pressure.

ELECTRIC ENGRAVER

What everybody has been waiting for. An Electric Engraver that works off your car battery.



Ideal for name tags, dog collars, plant labels. etc.

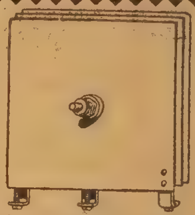
Engraves anything in metal

29/6

Engrave your name on all your tools. Marked tools are never stolen. No Garage should be without one.

Not Secondhand.

BRAND NEW ENGLISH G.E.C. RECTIFIERS



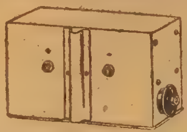
Make yourself a Battery Charger.

12v. 2 amp, 32/6
6v. [illegible] amp, 49/6
12v. [illegible] amp, 45/-
6v. 2 amp, 24/6
6v. 4 amp, 45/-
12v. 5 amp, 79/6

Transformers to suit above Rectifiers, 2 amp, 37/6; 6 volt, 5 amp, 45/-; 12 volt, 5 amp, 55/-.

COMPLETE BATTERY CHARGER

Fitted with Brand New English Selenium Rectifier.



Works off 230v. Household Supply

Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Chargers combined. Charge 2 amps, £7/15/-. Brand new 6 volt, 2 amp Chargers, complete, £5/2/6.

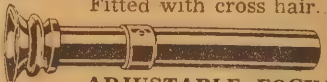
ARMY FOCUSING TELESCOPE

Easily converted for use on dumpy levels.

Can be used as a rifle sight.

Excellent magnification £4/19/6

Fitted with cross hair.



ADJUSTABLE FOCUS

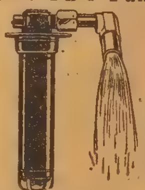
BALL AND SOCKET INSPECTION MIRRORS

8/9 each

Ideal for mechanics, radio repairs.

24-VOLT MOTOR COMPLETE With Fuel Pump

Ideal for Caravans. Takes the place of Hand Pumps



Many uses on the Farm. Will transfer Petrol or any Liquid from Drums, etc. Will work from 24 or 32 volts AC or DC.

£5 each.

ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING. FIT ONE TO YOUR CAR.

Fitted with Mirror Reflector.
6-volt 37/6 12-volt 25/-

English Motor and Blower, 24 volts.

39/6

Will work off any Lighting Plant.

Large size also available that will work off 12 or 24 volts £3/15/-.

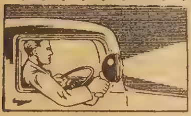
STORES

512 Elizabeth St., Melbourne, C.I.
from Victoria Street. Phone FJ5904.
and Efficiently Despatched.
Include State in Address.

Stock and Die Sets, ½in, ¾in, and 1in water pipe, £4/19/6

IN FIRST CLASS ORDER DALTON COMPUTERS IDEAL FOR AERO CLUB 45/-.

230 volt AC, NEON TESTERS, 4/6.



63/6

Complete with flex and switch.

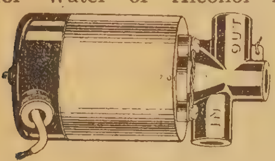
At last! The spotlight you have been waiting for

Fitted with genuine American sealed bean 6-volt globes. No motorist or boat owner should be without one.

Ideal for Fox or Rabbit Shooting.

LIQUID SHUT OFF VALVES

Will work off 12 or 24 Volt, ideal for Water or Alcohol Injectors.



50/-

Can be used as Petrol shut off for car protection. Many factory uses.

ARMY SPOTTING TELESCOPES

Many uses on the farm. Ideal for Sheep Spotting.

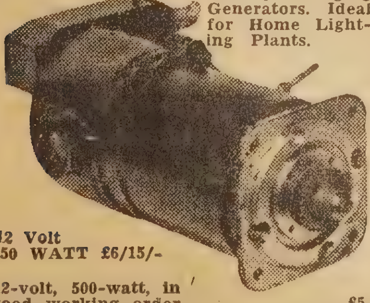
Useful on the rifle range, 3 draw 17in long, 6½in closed, 1in object lens, 18 magnification. Made in England **£7/19/6**

Brand new AEROPLANE WHEELS IDEAL FOR WHEELBARROWS

HAND TRUCKS, TRAILERS, etc.

10¾in x 4½in £4/15/-, complete with tube

Battery Charging Generators. Ideal for Home Lighting Plants.



12 Volt 750 WATT £6/15/-

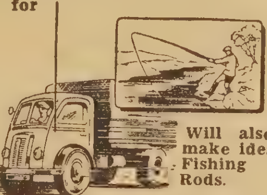
12-volt, 500-watt, in good working order	**£5**
12-volt, 500-watt, new	**£7/10/-**
24-volt, 1000-watt, Brand new ..	**£8/10/-**
200 amp Generator. Ideal for welding. Made in America. Brand new	**£50**
Tested and in perfect order ..	**£35**

SPECIAL DISPOSALS METER OFFER

0-10 amp meters, AC-DC 2¼in dial,	**45/-**
0-10 milliamp, 2½in dial	**37/6**
Weston 0-50 volt 0-100 amps combined M/coil,	**£3/10/-**
English 50-0-50 Ammeters, M/Coil	**37/6**
Eng. 0-50 Ammeters, AC-DC	**42/-**
English 0-40 Voltmeters, M/Coil .	**25/-**
English 0-300 AC-DC Voltmeters	**55/-**
English 0-5 Milliammeters, 2¼in. ..	**27/6**
English 0-25 Ammeters, 2½in M/c.	**30/-**
English 0-10 Ammeters, 2¼in dial, Moving Coil	**45/-**
English 0-30 Voltmeters, 2½in dial, AC-DC	**42/-**
English 0-40 Ammeters, 2¼in dial, AC-DC	**42/-**
Eng. 0-3 Ammeters, 2¼ dial, AC-DC	**45/-**
English 0-150 Voltmeter, 3in dial, Moving Coil	**39/6**
Eng. 0-500 Micro Ammeter, M/Coil	**37/6**
Eng. 0-150 Ammeter, 3¼in dial, AC-DC	**75/-**
Eng. 0-20 amps, 2in dial, M/c. .	**25/-**
Eng. 0-1½ Milliamps, 2in dial, M/c.	**19/6**
Eng. 0-20 Milliamps, 2¾ dial, AC-DC	**17/6**
Eng. 20-0-20 Ampmeter, M/coil	**37/6**
Eng. 0.30 Amps AC-DC 2¾in dial	**42/-**
Eng. 0-50 Amps AC-DC 3¾in dial	**75/-**
Eng. 0-60 Amps AC-DC 3¾in dial	**75/-**
Eng. 0-80 Amps AC-DC 3¾in dial	**75/-**
Eng. 0-1 Amps DC 2¼in dial .	**35/-**

STEEL ARMY TANK AERIAL RODS, WILL MAKE IDEAL RADIO AERIALS FOR CARS OR TRUCKS.

Too long for postage. Advise nearest railway station.



Will also make ideal Fishing Rods.

12ft long, 3 sections. Each section 4ft, 22/6. 8ft long, 2 sections, 15/-.

AMERICAN VACUUM or AIR PUMP

Builds up air pressure to 20lb at 1000 R.P.M. develops up to 120lb of hydraulic pressure; will pump 7½ gallons S.A.E. oil or other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems. **£3/10/-.**

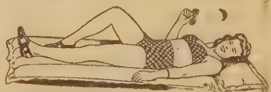
SPECIAL OFFERS

American Schrader tyre pumps, work from your spark plugs, **39/6.** Officers' solid leather shoes, black, **42/-.** Officers boots, **45/-** pr. Canvas car tool rolls, **8/6.** American long blade jungle knives, complete with sheath, **15/-.** Large size white handkerchiefs, **1/6** each. 4½in saw blades, complete with arbor, ideal for making saw bench with electric drill, **25/-.** 6ft wide waterproof canvas, **17/6** yd. Bell-ringing generators, ideal for telephones, **25/-.** German Army marching compasses, work similar to prismatic, **29/6.** 110 volt 1000 watt prosector globes, **32/6.** 24 or 32 volt fractional HP electric motors, make ideal grinder mixers, etc., **50/-.** Small 12 or 24 volt hobby motors, **39/6.** ¼in Black and Decker 230 volt electric drills, **£11/15/3.** ½in **£24/8/3.** Fish pond aerators, work from 230 volts, **57/6.** All Steel Mechanics' Tool Boxes, **19/6.** Magnifying Glasses, 8 mags, **8/6.** 10 magnifications, **12/6.** Metal Drill sets, 1-16 to 3-16, 9 Drills for **3/6.** 24 volt motor and hydraulic pump, capacity 3½gals. per minute, **£3/15/-.** New headphones suitable for crystal sets, **17/6** pair. New Army Mosquito nets, ideal camping, **35/-.** Genuine RAAF Berets, **10/6.** Surveyors Abney levels. New price £18/18/-, **£7/10/-.** Army paint, oil base, blue or grey, **25/-** gal. Brand new American Cutting and welding torches, **£4/4/-** complete. Army Slouch Hats in good order, **15/-.** Generator Test Meters, 35-0-35 amp meters, 4¼in dial, **45/-.** 0-10 volt meters, 4¼in dial, **45/-.** Loading Resistors can be supplied to make meter read 10.20 at **12/6.** Medical Scalpels, many uses, photographers, etc., **6/6.** Shaded Pole induction Motors made by Hoover of England, 230 volts, AC. Ideal for Projectors, Tape Recorders, Fans, ets., **£4/19/6.** SAE open end Spanners, 6 to set, **24/6.** Whitworth, 4 to set, **18/6.** 2½in Paint Brushes, set in rubber, special price, **10/6.** Brand new 7-8in Spark Plugs, suit most old type cars, **2/6 ea.** Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, **39/6.** 230 volts input Army Steel Tow Ropes with looped ends, **17/6.** SAE or Whitworth Spanner sets. Open one end, ring the other, 6 spanners to set, **23/6.**

JUST ARRIVED SPORTSMEN'S BINOCULARS, EXCELLENT QUALITY, 39/6 PAIR

LUCKY PURCHASE OF INFLATABLE RUBBER AIR BEDS

Ideal for Caravans, Cars, etc. Ideal for Hikers



Take one to the beach. Will float in water. **£4/19/6.**

GENUINE WATERPROOF AMERICAN STYLE SAFARI JACKETS.

FULL FRONT ZIPP FASTENER

65/-

IDEAL FOR MILKING OR ON THE MOTOR BIKE

The RADIOMASTER

RADIOGRAM CHASSIS...

a great performer on Radio and Records

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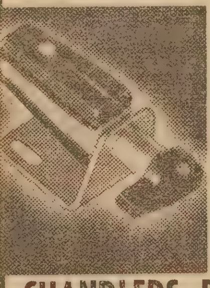

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HERE'S YOUR ANSWER TOM!

(Continued from Page 41)

that it cannot transfer signal voltages from plate to grid. This is where the bypass capacitor comes in.

You can charge a capacitor up to a certain DC potential, but it takes a certain definite time to increase or decrease that charge.

In the case of a screen bypass, the supply circuits may be arranged to apply, say, 100 volts to the screen and across the bypass capacitor. The fact that it may take a small fraction of a second for the charge to build up is of no consequence at all.

However, in an RF or IF amplifier the signal on the plate would have to vary the screen potential at a rate of perhaps hundreds of thousands of times per second, and this it simply cannot do, if we make the bypass capacitor large enough.

A conventional value is 0.1 mfd for an RF or IF amplifier — a value which is simply too large to be charged and discharged at the signal frequency.

As a result, the screen voltage "stays put" at the prearranged DC figure and no signal is transferred to the grid.

The function of the screen in an audio amplifier is more concerned with other functions of the tube than with plate-grid capacitance, but the same general requirement has to be met — the screen should not be able to change its potential in sympathy with the signal.

Since an audio signal is very much lower in frequency than an RF or IF signal, the storage effect of the screen bypass has to be greater, and therefore the capacitance required is often higher. In audio service, values are up to 8 mfd for certain applications.

AN EXTRA GUN FOR YOUR FLASH UNIT

(Continued from Page 95)

be used for the auxiliary units as was used in the main unit.

Regardless of the type of unit used, it is obvious that the charging time and demands on the batteries will be increased when the second unit is added. For this reason we don't particularly recommend the use of dry batteries when both lamps are to be operated, the AC mains or accumulator-vibrator version being more suitable.

EXPOSURE

Also, don't fall into the trap of believing that the extra light will decrease the stop opening required. In most cases the two lamps will be used to illuminate different parts of the subject, rather than to supplement one another on the same part, and so the exposure will remain approximately as for a single lamp mounted on the camera. In any case the increase in light would only amount to about one half stop, assuming that both lamps illuminated the same portion of the subject.

Finally, we are publishing an alternative triggering circuit for the low-voltage circuit, which will be useful when certain types of model aircraft ignition coils are used in place of the correct trigger transformer. Most ignition coils have only three connections, one end of the primary and secondary being joined together and brought out to a common lead.

The circuit given is most suitable for such an arrangement and may also prove slightly more efficient if a triggering circuit appears, for any reason, to be a little "cranky". It is, in fact, identical with that used on the original high voltage unit.

NO MYSTERY ABOUT DETECTION

(Continued from Page 19)

from the temperature of the body at the time it was found.

When a postmortem examination has taken place the doctor is in a position to give a more accurate determination of the time of death, no matter how much time has elapsed.

OTHER CHANGES

There are many external and internal changes which take place, such as the amount of food in the stomach and its condition, the condition of the blood in the heart and blood vessels, the disappearance of sugar from the blood and the type and quantity of bacteria in the body, which take place in a regular sequence and make the answer to the question much more exact.

It will thus be seen that the task of the chemist and medical man in crime investigation is a most important one. Without the detailed knowledge of the skilled man, the administration of justice would be much more difficult.

LET'S BUY AN ARGUMENT

(Continued from Page 85)

tor position necessary for an exact 455Kc. But that is all . . . just slightly to one side.

You will note that I have been careful to refer, in the foregoing, to an "ordinary superhet". The influence of tracking error could be much more apparent in sets having a high degree of RF selectivity and an over-coupled or stagger-tuned IF channel.

We could dream up curly ones also about band-pass circuits, &c., but they would merely be "red herrings" across the trail. And red herrings in that condition are rather nauseating!

As a general rule, an aviator can fly to a height of 15,000 feet before he needs oxygen. But the altitude varies with the individual and the time spent at that altitude. Some fliers are able to fly above 20,000 feet without oxygen for short periods, while others may require oxygen for prolonged flights below 15,000 feet.

FROM THE SERVICEMAN WHO TELLS

(Continued from Page 77)

This immediately suggested that the water pipe was doing the job of the neutral line and, in turn, that the neutral line itself was faulty.

This cause was not hard to find. An examination of the meter board and associated wiring revealed that the neutral wire was open—in fact visibly broken—just above the bell-mouth where the wires entered the building. It so happened that this fault was not readily visible unless one looked carefully and so had, presumably, been in that condition for some time.

Since the neutral was connected to the water pipe from a point near the meter the situation was not serious as long as the earth system was intact, the water pipe serving as a neutral line. Immediately this path was broken by the plumbers and an appliance switched on, the entire water service in the house was effectively connected to the active side of the mains.

Fortunately, no one was taking a bath at the time!

Having located the fault I called a halt, for the job was clearly outside my jurisdiction. I merely rendered the place safe by pulling out the fuses and left it to the local supply authorities to repair the broken neutral.

I still shudder when I think how close the situation came to a serious accident.

A SET FOR YOUNG DX-ERS

(Continued from Page 71)

enthusiasts will remember, a scraping contact between gang shaft and panel can cause noise in the set when tuning on the short waves.

In other respects the layout is fairly straightforward. We have suggested a 6-pin coil socket and formers, and marked a suggested pin numbering. Mount the socket so that the lead from the fixed plates of the tuning capacitor passes straight through the chassis to the "grid" end of the coil.

The detector socket should then be mounted to give fairly short runs to grid and plate.

The remainder of the layout is not critical and components can be mounted with an eye to order and rigidity.

Watch the polarity of the electrolytics and terminate the power leads in a way which will not invite contact with roving fingers.

Space does not allow any dissertation on the winding of coils and this will have to be taken for granted on this occasion. All the necessary winding data is given, however.

Once these are done, you can settle down to many hours of enjoyable listening. Perhaps you will share the pleasure of the lad who came into the office, a few days ago, with a tale of how he had listened to messages being passed to and from a whaling fleet in the Antarctic. His set? A little regenerative job, not nearly as pretentious as this one.

GETTING YOUR LICENCE

(Continued from page 59)

tuned circuit associated with both grid and plate. By using a pentode, the screen generally provides enough shielding to prevent this, although at high frequencies it is good practice to neutralise the valve as well.

In Fig 1 the output circuit is C9 and L3, with L4 the coupling coil for aerial connection. The screen is invariably operated at a lower voltage than the plate, and in this case, the suggested value of 200 volts would be suitable for the oscillator plate. The oscillator screen voltage is obtained via R2.

The transmitter could be keyed in the 6V6 cathode circuit in conjunction with a simple resistor-condenser click filter. It is quite a practicable circuit but is intended primarily as a "typical" arrangement to illustrate fundamentals of design.

The connections for a neutralised triode are shown in Fig. 2. The general theory of the amplifier circuits already covered applies to this circuit, except that the feedback from plate to grid would cause amplifier oscillation without neutralisation.

Neutralisation consists of applying to the grid a voltage equal to that fed back from plate to grid through the valve, but of opposite phase so that the two voltages cancel each other.

The opposite phase is obtained by earthing the output coil at the centre. Under these circumstances, the voltages appearing at each end of the coil will be equal in amplitude but opposite in phase.

By means of C4, a very small variable condenser, the correct amount of voltage is fed to the grid to neutralise the valve.

A good method of neutralising is as follows:—

1. Insert a milliammeter between the bottom of the grid leak and earth (point X). Apply voltage to the oscillator, but not to the amplifier, so that the meter reads the amplifier grid current.

2. Rotate the amplifier plate tuning conductor until a dip is noticed on the meter, indicating a change of grid current. This will occur when the condenser is adjusted to resonance.

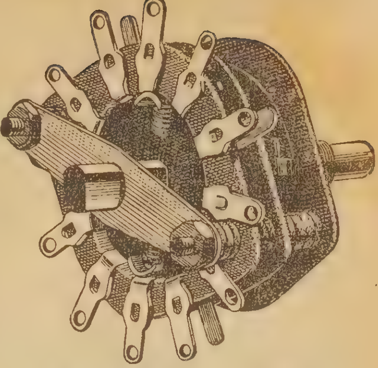
3. Adjust the neutralising condenser until you can rotate the plate tuning condenser with no sudden dip in grid current. Adjusting beyond this setting will bring the dip in grid current into evidence once more.

Case for GP Junior

(Continued from Page 43)

Before applying, dust the case carefully with a clean cloth to remove any loose wood dust. The application is not particularly critical and, when thoroughly dry, it should be rubbed down lightly with fine sandpaper. This should provide a correct surface for the final color.

Fittings consist of slip hinges, clip fasteners, rubber feet, handle, and, optionally, nickel-plated brass "corners" on each corner of the case to protect it. Rubber feet should be fitted to each corner of the bottom of the case and also the end of the case opposite the handle.



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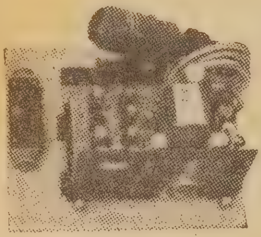

NEW AMERICAN INDICATOR-UNIT

These Indicator Units contain the following Valves:— Six 6SN7GT, one 6G6, one 6H6, one 6X5GT, one 2X2 and 3BP1 C.R.O. tube which is fitted in a separate shield on a 4ft shielded lead and supplied with control box and plug; case and shield are finished in black brocade.

£10/17/6 F.O.R.

IN ORIGINAL CARTON

HIGH RESISTANCE HEAD PHONES (3000 Ohms)

THESE PHONES ARE USED BUT IN GOOD CONDITION SUPPLIED WITH HEADBAND AND CORD. .. .. **22/6** per pair.

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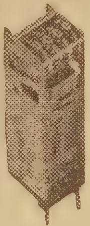

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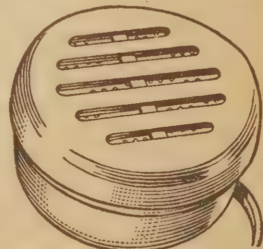
Install it anywhere, in the sickroom, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED. 3½in Diameter by 1¾in deep. POST FREE **22/6**



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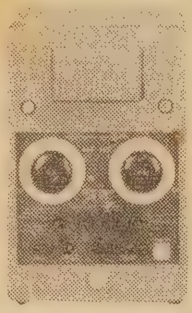

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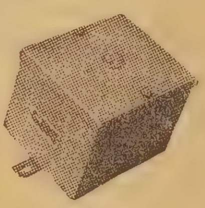

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Ideal for oscilloscopes or TV sets.
New 6in tubes.

VCR97	47/6
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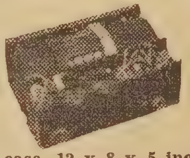
SCR 522 GENEMOTORS



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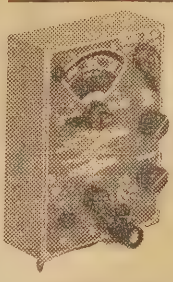

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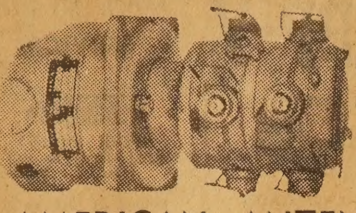

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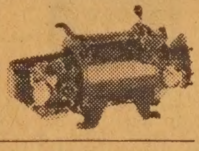

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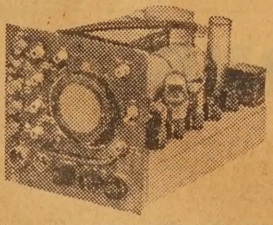

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20	4/-	7/6	10/-
22	2/9	5/-	7/6
24	2/6	3/4	4/9
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ANSWERS TO CORRESPONDENTS

N.J.W. (Horsham, Vic.) raises the question of safety in mains operated equipment, particularly with regard to the part played by the "earth". He is apparently puzzled by a recent newspaper report of a fatal electrical accident.

A. Without exact details of the accident, and being unwilling to base judgment on a non-technical newspaper report, we would not like to be too definite in our explanation. However, the follownig points may be of interest. The earth only enters into the scheme of things because one side of the mains is deliberately earthed at the power station or sub-station. This means that the earth is equivalent to one side of the mains and accidental connection to the other side (the active wire) and earth will produce a shock. The seriousness of the shock will depend on the nature of the earth connection. Thus a person touching a water pipe or standing on damp ground in damp shoes could easily receive a fatal shock. On the other hand almost any dry non-metallic object, such as a door mat will provide sufficient insulation to protect a person from all ordinary mains voltages. A person who is caught on a line may be freed in the manner you describe because the clothing is a poor conductor, if it is dry. (Avoid the armpits.) However, a rescuer would be well advised to stand on a dry insulator of some kind if this was readily available.

In the case of your equipment it is advisable to earth the metal frame and this will provide complete protection in the event of a failure of any components inside the set. It is assumed that one side of the line is already earthed.

B.McL (Mansfield, Vic.) wants to know the number of turns and gauge of wire to use for a transformer to connect a pair of headphones to a radio set.

A. It won't be necessary for you to wind a transformer to do this job, B.McL., because there is already a suitable transformer in the set. This is the speaker transformer and you will find that the headphones will provide a suitable signal strength when they are connected across the secondary winding. If the speaker is not to be operated at the same time it may be disconnected from the secondary and should be replaced by a resistor of approximately the same value as the voice coil. About three ohms will suit in most cases. Another connection is between plate and chassis, using a capacitor of about .1 mfd in series with the plate lead to prevent the flow of DC through the headphones and to protect the user. This arrangement usually gives too high a signal level which is difficult to control and aggravates the hum level.

R.W. (Bellevue Hill, NSW) has a one valve battery set and wants to know how to convert it to AC operation.

A. It is not a simple matter to convert the set as you suggest, about the best that can be done is to use a small power pack to supply the 45 volts HT and retain the three volt filament battery since this latter is the hardest to replace with a power unit. We have some circuits on our files of simple "B Battery eliminators" which would serve as a guide and these are available through the postal service. However, they are not exactly what you require and some experimenting would be necessary to modify them for your needs. It is unlikely that the valve you mention would be of any use in the power supply, since the diode plates would not handle the current required, but it may be possible to substitute it for the battery valve now in the set. In this case it could be operated from a 6.3 volt winding on the transformer. If we had further details of the battery valve already in use and the valve you intend to substitute we may be able to advise you on the possible success of the change.

T.C.D. (Hazelgrove, NSW) writes to advise a change of address and to inquire whether we have ever published anything on the subject of black light.

A. We have attended to the change of address, T.C.D., and all future issues will be forwarded to it. We have never published any data on black light, though it is normally ultra-violet or infra-red light which has been made visible by means of fluorescent chemicals. Unfortunately we cannot direct you to any other sources of information.

V.D., (Griffith, NSW) wants to know where he can obtain a flash gun camera which uses PF14N flash bulbs which will give 1000 flashes. He also requests we publish some details about Morse code.

A. We are afraid you are a little off the track, V.D., in the matter of flash bulbs, since the PF14N is an expendable bulb good for one flash only. The electronic flash tubes are good for at least 10,000 flashes and we have several circuits on our files which describe these units. There is another type of unit which has enjoyed limited popularity and this employs a lamp similar to a photoflood, powered from the mains, and which is energised only when the shutter contacts close. These have been available from most of the Sydney photographic stores. An article on the Morse code appeared in the Short-Wave Handbook and a few copies are still available from this office, price 2/-.

R.H.D. (Busselton, WA) wants to know what is the range of the longest range crystal set we have ever described and whether it is possible to construct a one valve set on a wooden baseboard instead of the conventional metal chassis.

A. It is impossible to quote any specific range for a crystal set (or any other set for that matter) since so much depends on local conditions, the strength of the stations, the amount of interference which can be tolerated between stations, the size of aerial and effectiveness of the earth which can be provided, and even the type of headphones which are used, so that exact figures are impossible. We are in the habit of stating that 15 miles is about the maximum distance, under favorable conditions, which can be expected. One of the most satisfactory units we have described so far appears in the August issue.

It is quite feasible to construct a one valve set on a wooden baseboard and we have several circuits which could be so constructed, even though they are not described specifically for this method of construction.

K.B.W. (North Essendon, Vic.) writes to inquire about the "All Wave Battery Two" of the March issue and to inquire what changes would be necessary to use the set with a 67.5 volt battery. He also inquires whether the two valve short-wave receiver described in the Short-Wave Handbook is out of date.

A. It should be possible to use the "All Wave Battery Two" with 67.5 volts HT without any major changes, though it is doubtful whether there is anything to be gained by such a change. If it is used it may be worth while experimenting with higher values of bias resistor for the 3V4, since a high power output is not necessary and the battery drain may be reduced considerably by increasing the bias. The higher voltage may also make the reaction a little critical and it may be necessary to reduce the screen voltage to the 1T4.

The short-wave set you refer to cannot be considered out of date, except in the sense that the valves employed are not the current types. However, it is still capable of giving very good results as a first set for the experimenter and it could be modified to take more modern valve types.

C.H. (South Perth, WA) writes to congratulate us on the design of the No. 4 Control Unit. His only query is that some 12AX7 valves are noisy and his preferred arrangement would have two EF86 valves in its place.

A. We agree that the EF86 valves are to be preferred electrically but we also have to keep an eye on the cost. In actual fact we have found that the 12AX7 is generally good enough though with no great margin to spare. Many readers like the feedback approach for tone compensation but we doubt whether the advantages are as real as some claim. We may describe one in the future but all these things take time and we only have a limited amount of it available.

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ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to others readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 4/6. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

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SELL: All R. & H. from 1946, amplifiers, test gear, A.R.C. course, ref. books, &c. **Perry, Wollar, N.S.W.**

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EXCHANGE: Admiralty Handbook, Vol. 1 and Vol. 2, for A.O.R.S.M. No. 9, or will buy. **Box 13, Epping, N.S.W.**

WANTED: Altec-Lansing or Goodman Loudspeaker. **Box 1, Huonville, Tas.**

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SELL: Type 3 Mark II, complete with in-built modulator, £22½. Transformer, 240/110 volt, 5 KVA, £20. **346 Gardeners Rd., Kingsford. FF2178.**

KARSET

(Continued from Page 53)

against ignition noise, but it can occasionally increase hash troubles. If shorting the choke cuts down the hash, therefore, we suggest you remove it altogether. It was not used in the 4-valve version.

After this, you can try extra bypasses on the filament and B-plus lines, remembering that there may be a difference in their effect if installed alternatively at the supply or the set end. Occasionally a lone bypass at one end is better than a bypass at each end.

Things like this can only be the subject of "cut-and-try", however, complicated in the last resort by the need to make the change, then to slip the units back into their cases for a test.

You should be able to get the set completely quiet with the aerial shorted out. With a short aerial connected, there may be some trace of hash, with the set simply resting on the test bench. This need not cause any alarm, however. With the set installed in the car and earthed thereto, and with the aerial outside the car body, you will probably find that the set is now perfectly free from hash and able to tune right down into the noise level.

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